MIE ELECTRICAL

MASTER INSTALLATION ELECTRICIAN

One project at a Time

info@mieelectrical.co.za | www.mieelectrical.co.za | 071 299 4344

Pietermaritzburg Transfer

Electrical Installation Handover File

Compliance, Test & Documentation Record

MIE Electrical (Pty) Ltd
Master Installation Electrician – Reg No: MIE 1982
Tel: +27 ... | Email: info@mieelectrical.co.za

Front Page – Project Details

Project name
Pietermaritzburg Transfer PLC

Client / User
Afgri Grain Management

Site / installation address
186 Ohrtmann road, Willowton, Pietermaritzburg, 3201

Project / reference number
MIE-Afgri 28/10/2025

Handover date
2025/12/16

Compiled by
Martin Erasmus

MIE Electrical contact details
Martin Erasmus
martin@mieelectrical.co.za
0712994344

Client representative / contact
Niel Scholtz
niel.scholtz@afgri.co.za
0764034731

Scope summary

Install a new plc at Afgri pietermaritzburg for transfer of grain to the Animal feeds side. The system must operate automatically 24hours a day. Program the auto sequence for a primary route and secondary route.

Handover compiled by (MIE)
Name, signature & date

Handover received by (Client)
Name, signature & date

Index

Use this index to track which sections and attachments are included in the handover file. Page / reference can refer to printed page numbers or attachment references (e.g. Annexure A, PDF filenames, etc.).

Section	Description	Page / Ref	Completed
1	Project & scope overview	Annexure A	☑
2	Certificates & legal documentation	Annexure B	☑
3	CoCs & electrical test reports	Annexure E	☑
4	Drawings, schematics & layout plans	Annexure C	☑
5	Hazardous area / Ex documentation	N/A	☐
6	Test results, studies & calculations	Annexure D	☑
7	O&M manuals, training & instructions	Annexure F	☑
8	Outstanding items / snags	Section 8	☑
9	Final sign-off & acceptance	Section 9	☑

Section 1 – Project & Scope Overview

Use this section to give a high-level technical summary of the installation and the work carried out by MIE Electrical, including any constraints, shutdowns, dependencies or special conditions.

Describe the existing installation, new works, interfaces, shutdowns, commissioning approach, and overall intent of the project.

Key stakeholders

Client representative	MIE responsible person	Other key parties
Niel Scholtz	Martin Erasmus	Erhard Conradie

Section 2 – Certificates & Legal Documentation

List all statutory and contractual documents handed over (e.g. contractor registration, health & safety, permits, appointments, agreements).

No.	Document	Reference / No.	Issued by	Date	Attachment / File ref
1	Registration With D.O	Annexure B	Department of Labou	2023	Annexure B-1
2	SAFA Registration	Annexure B	SAFA	2025	Annexure B-2
3	Qualifications	Annexure B	Approved Institution	2012/17/24	Annexure B-3
4					

Section 3 – CoCs & Electrical Test Reports

Record all Certificates of Compliance and associated test reports issued as part of this handover. Each entry should correspond to a CoC or CoC group (e.g. DB, area or project phase).

No.	CoC number	Scope / installation description	Registered person	Date	Attachment / File ref
1	MIE-20251216-1150	Main supply	Martin Erasmus	1/11/2025	Annexure E
2					
3					

Additional CoC / test report notes

Generator Installation

Section 4 – Drawings, Schematics & Layout Plans

List all drawings forming part of this handover (SLDs, schematics, earthing, panel layouts, floor plans, etc.).

No.	Drawing title	Drawing No. / Rev	Type	Prepared by	Attachment / File ref
1	PLC I/O	Merged Document	Single Line Diagra	Martin Erasmus	Annexure C
2	Electrical Schematic	Merged Document	Single Line Diagra	Martin Erasmus	Annexure C
3	Panel Layouts	Merged Document	Panel Layout	Martin Erasmus	Annexure C

Section 5 – Hazardous Area / Ex Documentation

Use this section for SANS 10108 & SANS 60079 documentation: Ex equipment registers, IS loop calculations, classification reports, inspection forms, etc.

No.	Document / item	Type	Zone / Area	Reference / Dossier	Attachment / File ref
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A

Additional Ex notes

Notes on Ex inspections, remedial work, restrictions, IS loop margins, dossiers kept on-site, etc.

Section 6 – Test Results, Studies & Calculations

Summarise all system studies and key test results: load flow, PSCC, volt drop, earth continuity, earth resistance, relay settings, etc.

No.	Study / test	Software / method	Reference / Report No.	Attachment / File ref
1	Etap Loadflow Diagram a	Etap	Annexure D-1	Annexure D
2	Etap PSCC Diagram and r	Etap	Annexure D-2	Annexure D
3				

Summary of critical findings

No critical faults

Section 7 – O&M Manuals, Training & Instructions

List all operation & maintenance manuals, OEM instructions, training materials and handover presentations.

No.	Item	Equipment / system	Supplier / OEM	Attachment / File ref
1	PLC switchgear	PLC	Phoenix	Annexure F
2	Electrical Switchgear	Electrical	ACDC	Annexure F
3	VSDs	Electrical	INVT	Annexure F

Training & handover sessions

Training was given to the onsite personnel and was assisted during the first 2 months after commissioning remotely to ensure they understood how the system works.

Section 8 – Outstanding Items / Snags

Record any outstanding defects, snags or conditional items that remain at the time of handover, together with agreed completion dates or responsibilities.

No.	Description of snag / outstanding work	Area / reference	Responsibility	Target completion date	Closed (Y/N)
1	Flow rate display	Animal Feeds	MIE/Afgri	30/01/2026	N
2					
3					

Section 9 – Final Sign-off & Acceptance

This section records final acceptance of the handover documentation and the electrical installation, subject to any outstanding items noted in Section 8.

MIE Electrical – Handover confirmation

Name (block letters): MARTIN ERASMUS

Capacity: DIRECTOR

Date: 2025/12/16

Signature (sign in this space on printed copy)

Client – Acceptance of handover

Name (block letters): NEIL SCHOLTZ

Capacity / Position: PROJECT ENGINEER

Date: 2025/12/19

Signature (sign in this space on printed copy)

Additional notes / conditions

Awaiting Feedback on flow rate address from RONIN Systems to display tp/h for Animal Feeds

ANNEXURE A

Project and Scope Overview

MIE ElECTRICAL (PTY) LTD
Address: 38 Annie Road, Witbank, Mpumalanga
Company Registration Number: 2024/030259/07
Email:martin@mieelectrical.co.za
Registration Number: MIE 1982

Director – Martin Erasmus
VAT Number: 4160318210
Tel: +27 71 299 4344
Website: www.mieelectrical.co.za
DOL Number: MP00502

Pietermaritzburg Transfer System

1. PROJECT DESCRIPTION

MIE Electrical (Pty) Ltd is appointed to design, supply, install, configure, test, and commission a PLC-based automatic grain transfer system for the controlled transfer of grain from AFGRI Pietermaritzburg to the Animal Feeds Factory.

2. SCOPE OF SUPPLY AND WORKS

2.1 Electrical Power Distribution

• Verification of existing electrical supply points

• Installation/modification of motor feeders and protection

• Compliance with SANS 10142-1

2.2 PLC Control System

• Supply and configuration of PLC

• Development of automatic transfer logic

• Manual and automatic operating modes

2.3 Field Instrumentation & Inputs

• Level switches and sensors

• Speed and belt drift switches

• Emergency stop circuits

2.4 Interlocking & Safety Logic

• Equipment interlocks

• Fail-safe shutdown logic

2.5 HMI

• Equipment status and alarms

• Manual controls

2.6 Cable Installation & Terminations

• Installation, tagging and termination of cabling

2.7 Testing & Commissioning

• I/O testing

• Functional and live testing

2.8 Documentation & Handover

• As-built drawings

• PLC backups

• Handover documentation

ANNEXURE B

Certificates and Legal Documentation

ANNEXURE B-1

Registration with D.O.L

employment & labour

Department:
Employment and Labour
REPUBLIC OF SOUTH AFRICA

ERASMUS MARTIN
48 ELANDSPRUIT
MIDDELBURG
1050

Enquiries: David Maila
Tel. Direct: 013-655-8791
Reference: MP 00502
Date: 24/02/2023

Attention: **MR. ERASMUS MARTIN**

Dear Sir/Madam,

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993
ELECTRICAL INSTALLATION REGULATION REGISTRATION 6(4): REGISTRATION OF ELECTRICAL CONTRACTOR

Your application dated **(24/02/2023)** for registration as an electrical contractor refers.

You are hereby registered as an electrical contractor in terms of regulation 6(4) of the Electrical Installation Regulations for the period from **24/02/2023** TO **23/02/2026** with registration number **(MP00502)** in the following category:

Any electrical installations

The following registered person(s) has been placed on the database of the department under the above mentioned electrical contractor:

	Name	Registration number
1	**MR. ERASMUS MARTIN**	**MIE 01982**

This registration may be withdrawn in terms of regulation 12(1) of the Electrical Installation Regulations failing to comply with the above regulations.

Yours faithfully

ff For Chief Inspector

DEPARTMENT OF EMPLOYMENT & LABOUR
INSPECTION AND ENFORCEMENT SERVICES
2023 -02- 24
PROVINCIAL OFFICE
PRIVATE BAG X7263 WITBANK 1035
DEPARTMENT OF EMPLOYMENT & LABOUR

ANNEXURE B-2

SAFA registration

2025 / 2026

MEMBERSHIP

CERTIFICATE

This certifies that

MIE Electrical (Pty) Ltd

is a Full Member of SAFA

And has undertaken to uphold the objectives of the Association especially with the regard to improving safety and quality of equipment in hazardous locations, environment, industry and mining.

GPillay

GERHARD PILLAY
SAFA PRESIDENT

ANNEXURE B-3

Qualifications

MEESTER INSTALLASIE-ELEKTRISIËN
MASTER INSTALLATION ELECTRICIAN

REGISTRASIESERTIFIKAATNR. 01982
REGISTRATION CERTIFICATE NO.

WET OP BEROEPSGESONDHEID EN VEILIGHEID, 1993
THE OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

I.D. NOMMER 901129 5080 087
I.D. NUMBER

NAAM ERASMUS MARTIN
NAME

HANDTEKENING VAN GEAKKREDITEERDE PERSOON/ SIGNATURE OF THE ACCREDITED PERSON

DEPARTEMENT VAN ARBEID

DEPARTMENT OF LABOUR

Hiermee word gesertifiseer dat die houer van hierdie kaart wie se identiteitsnommer, naam en handtekening op die keersy verskyn, kragtens Regulasie 9 van die Elektriese Installasie Regulasies uitgevaardig ingevolge die wet op Beroepsgesondheid en Veiligheid 1993, geregistreer is as 'n geakkrediteerde persoon.

It is hereby certified that the holder of this card whose identity number, name and signature appear on the reverse side, has in terms of regulation 9 of the Electrical Installation Regulations made under the Occupational Health and Safety Act, 1993, been registered as an accredited person.

2017/05/08
DATUM/DATE

HOOFINSPEKTEUR/CHIEF INSPECTOR

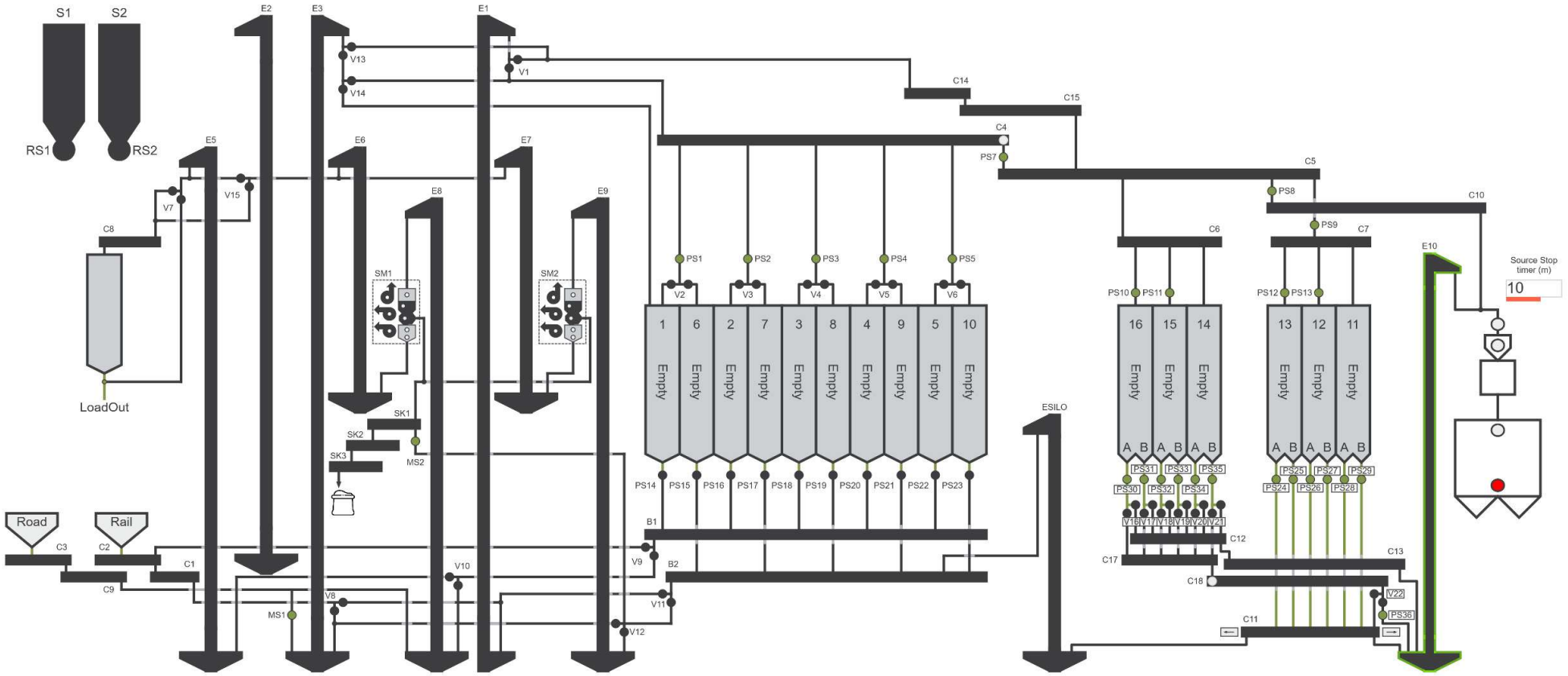
ANNEXURE C

Drawings, Schematics and Layout plans

View Device Info

PLC IO | RIO1 IO | RIO2 IO | RIO3 IO | RIO4 IO

Show Amps



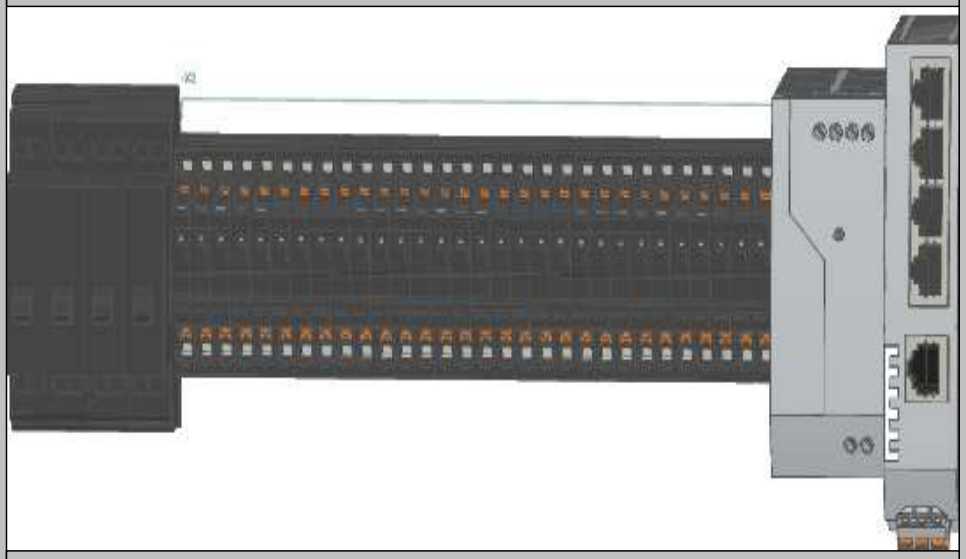
RIO Connection Status

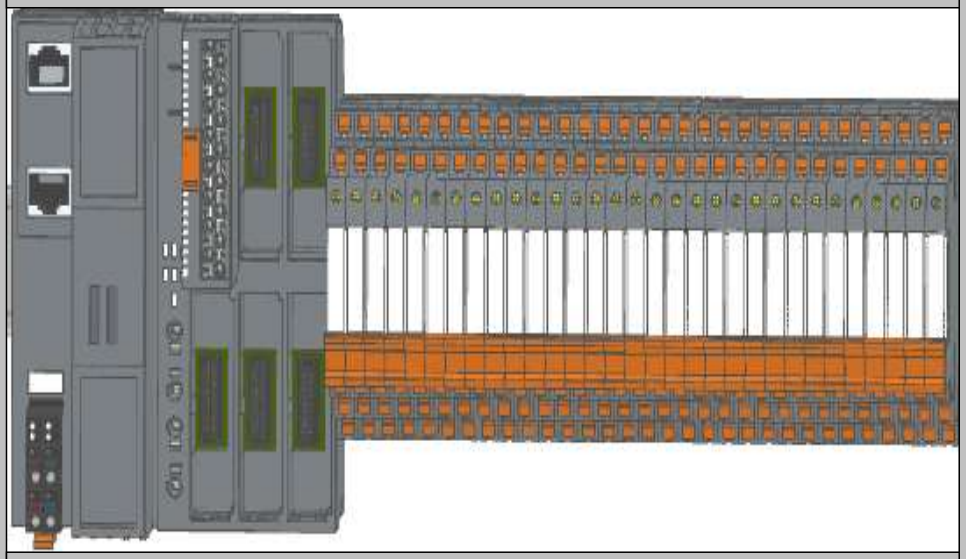
RIO 1 | RIO 2 | RIO 3 | RIO 4

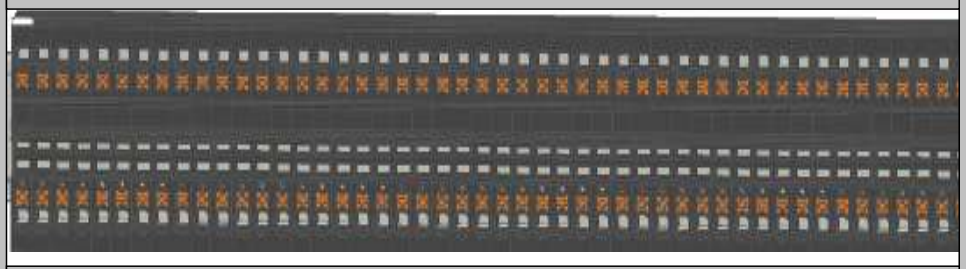
Animal Feeds

Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **FLOW DIAGRAM** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **1/42**

RIO 1







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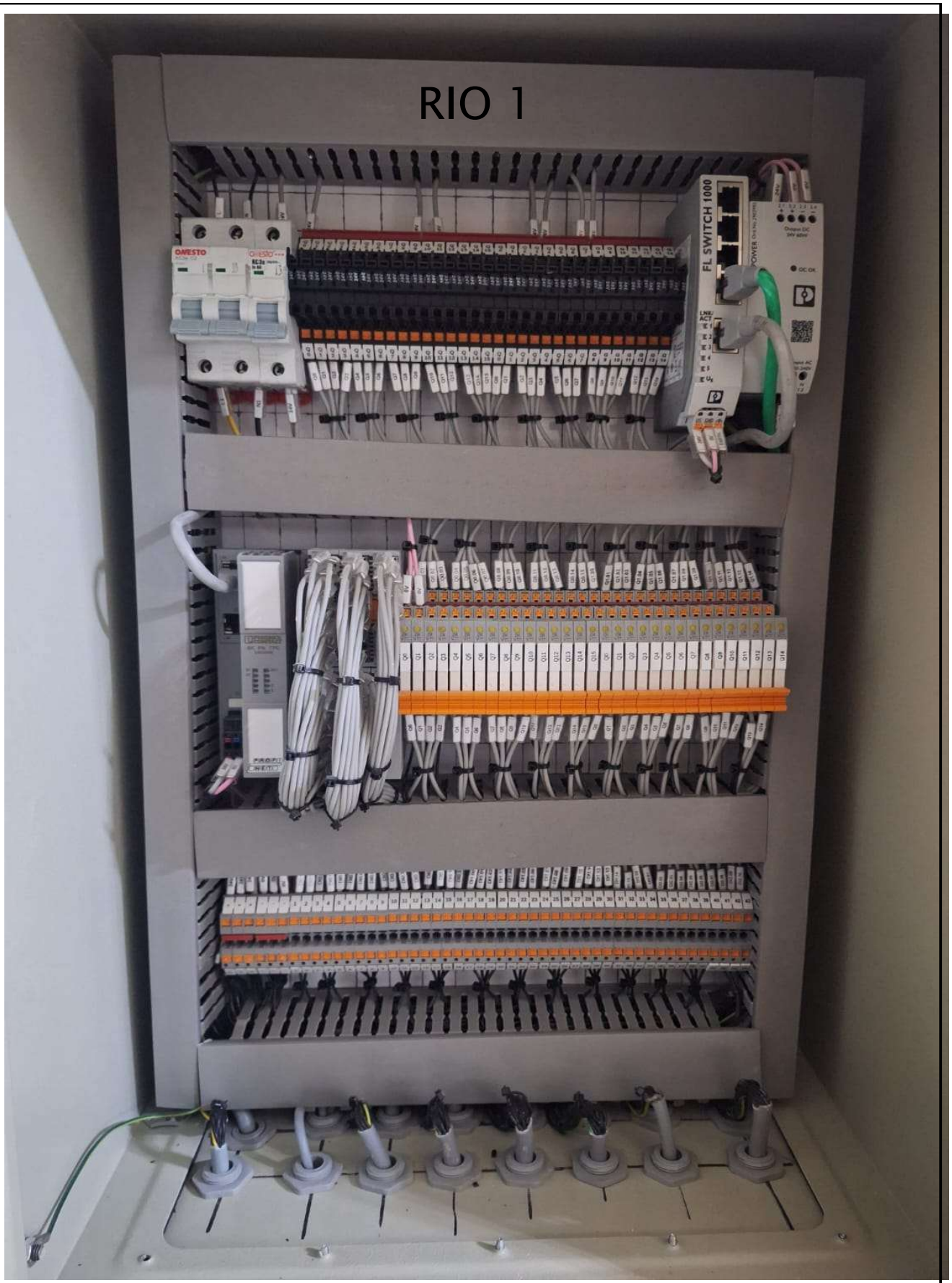
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 1 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **2/42**

RIO 1



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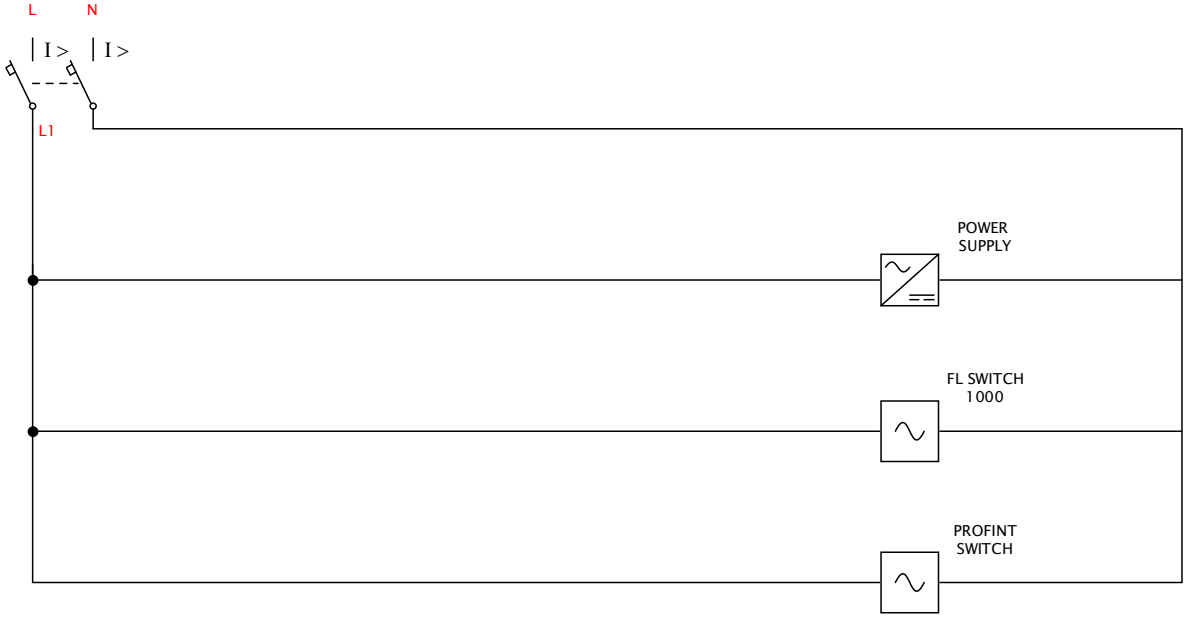
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 1 PICTURE PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale / Lang. / Sheet **3/42**

RIO1 230V Control

SUPPLY
FED FROM
C17/C18 DB



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	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 1 230V CONTROL** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **4/42**

RIO1 24V Control

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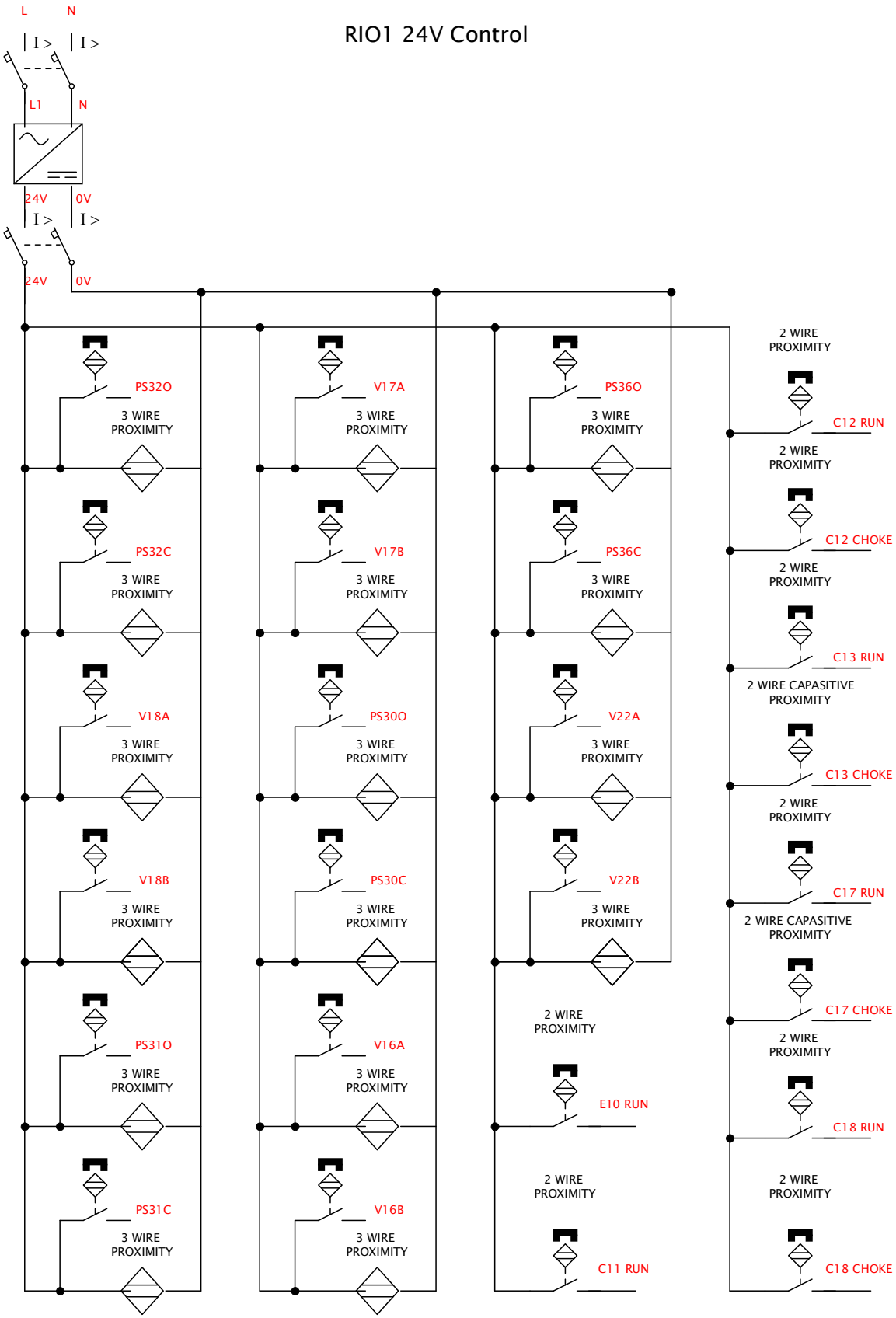
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 1 24V CONTROL** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **5/42**

RIO1 24V Control



Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
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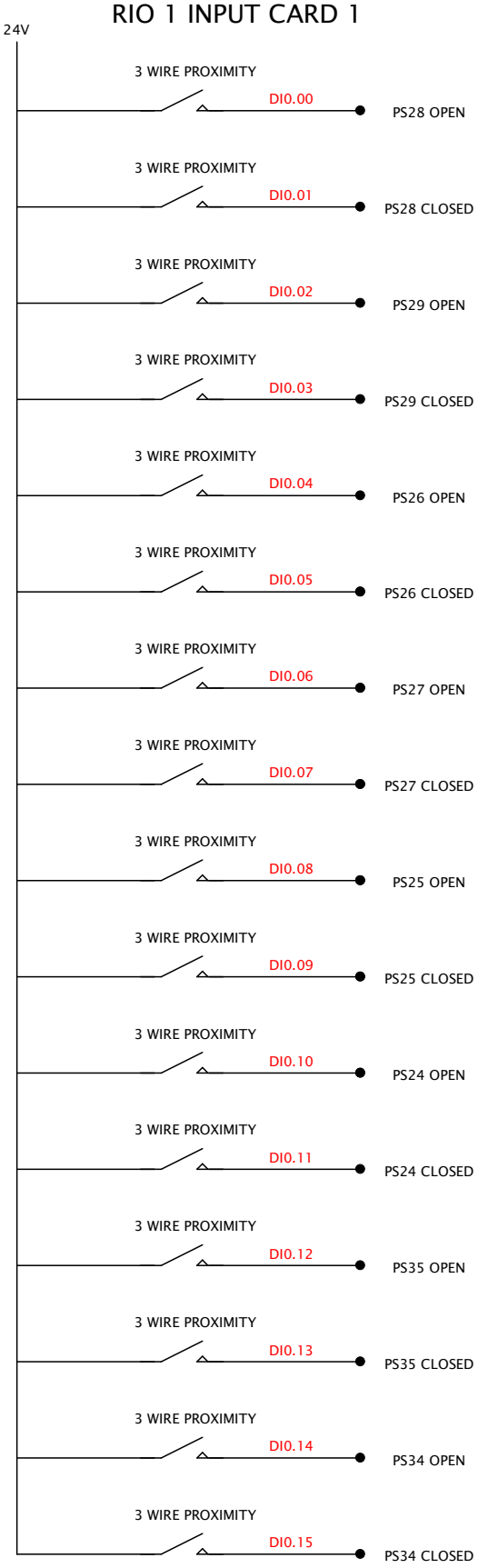
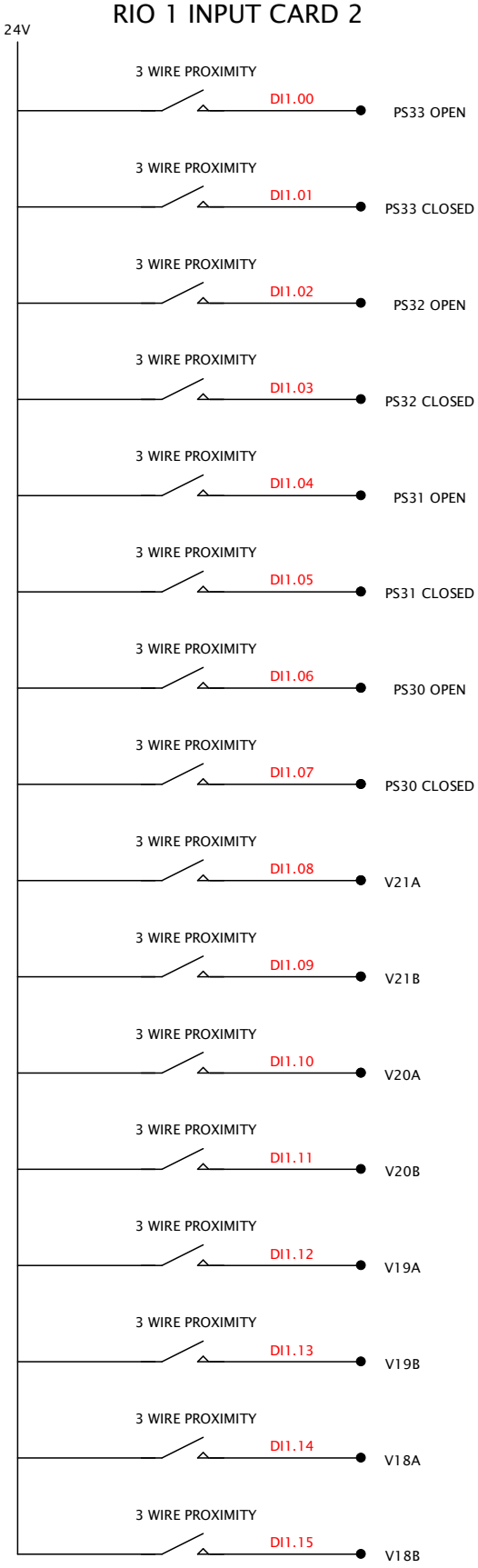
RIO 1 INPUT CARD 1



RIO 1 INPUT CARD 2



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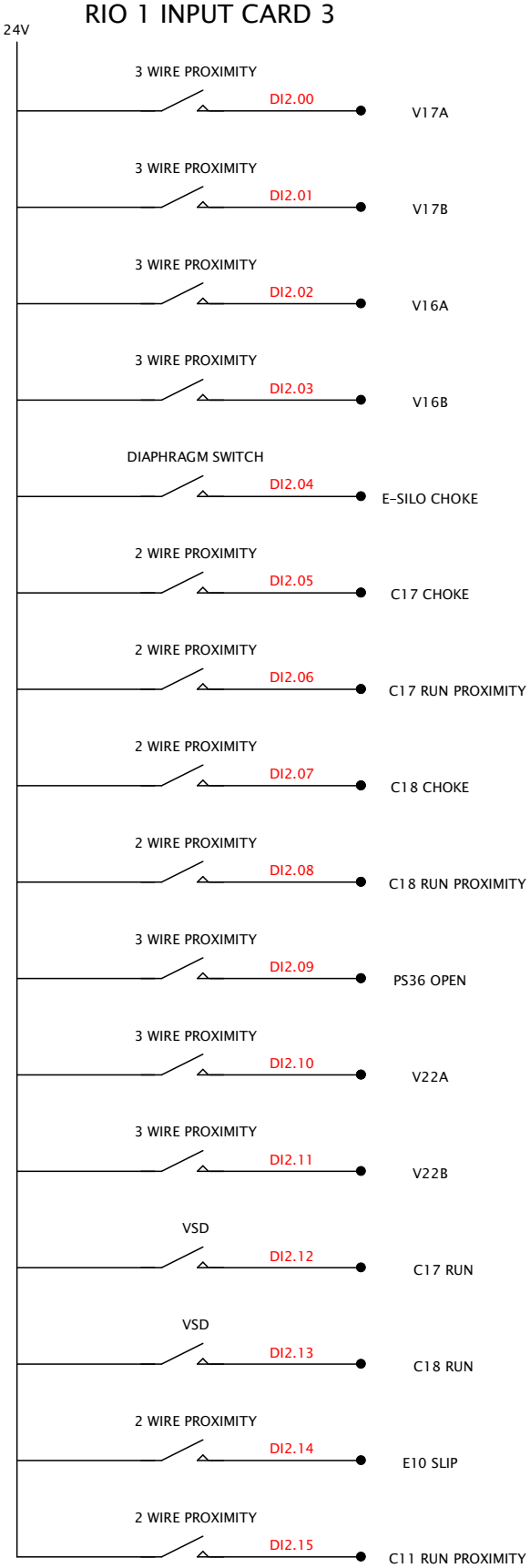
RIO 1 INPUT CARD 3



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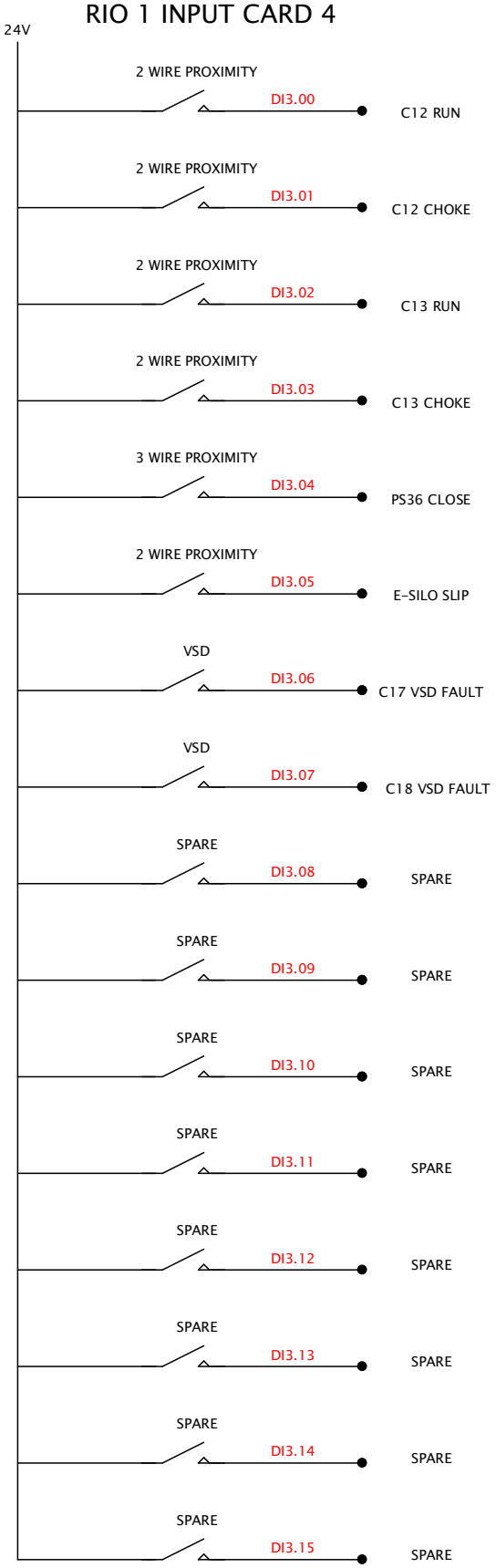

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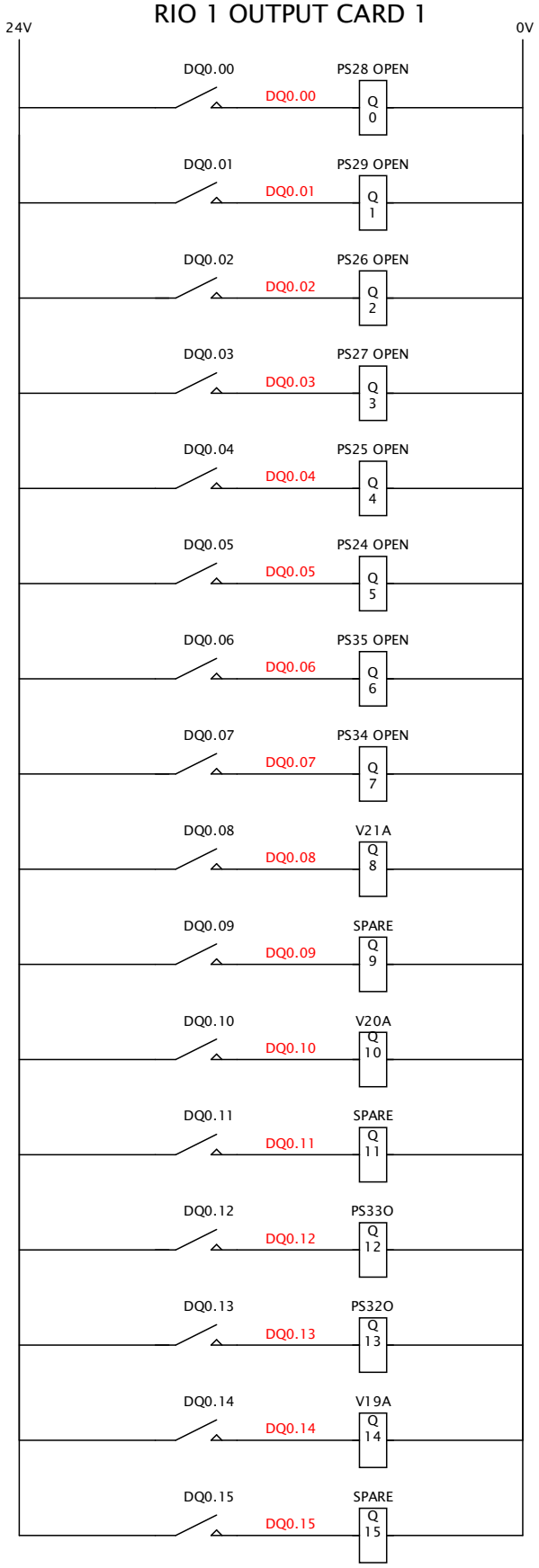
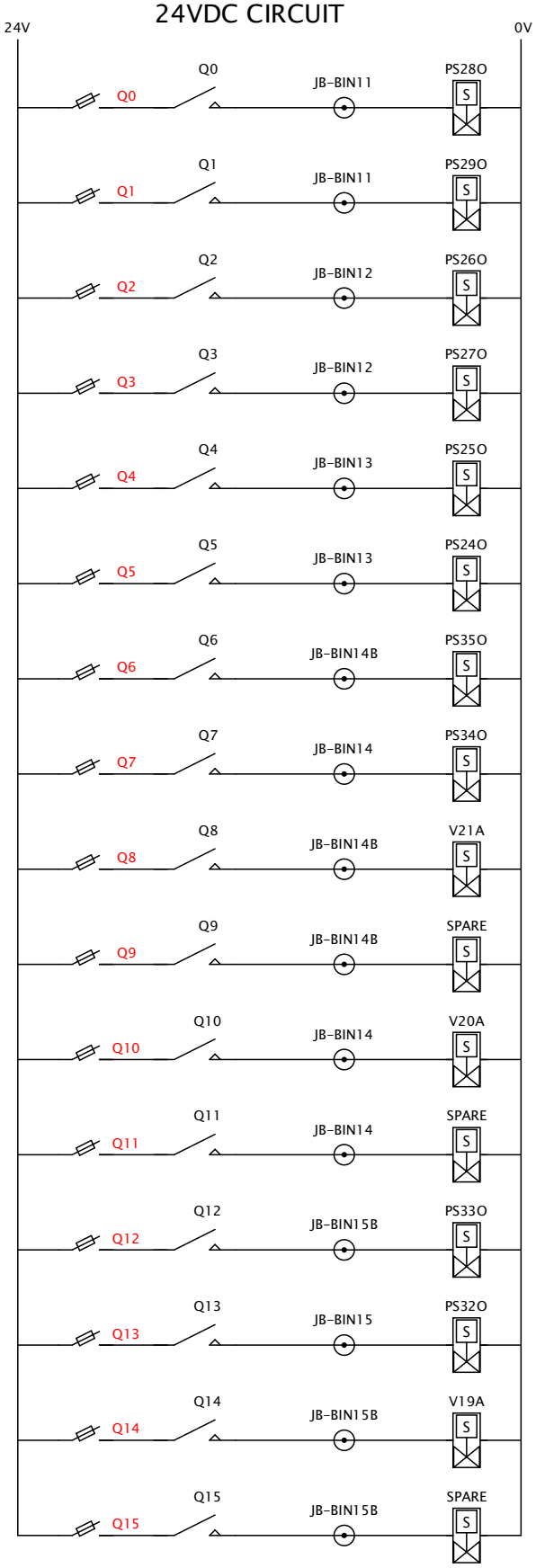
RIO 1 OUTPUT CARD 1



24VDC CIRCUIT



Responsible dep.	Technical reference	Created	Approved	
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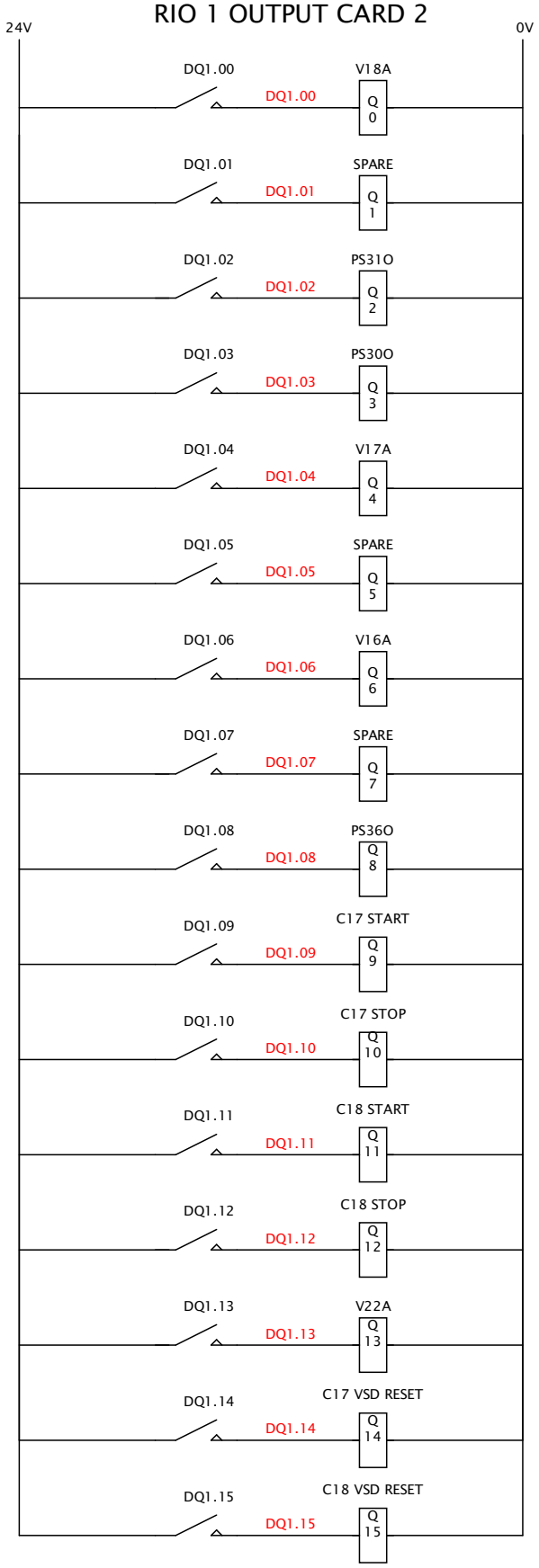
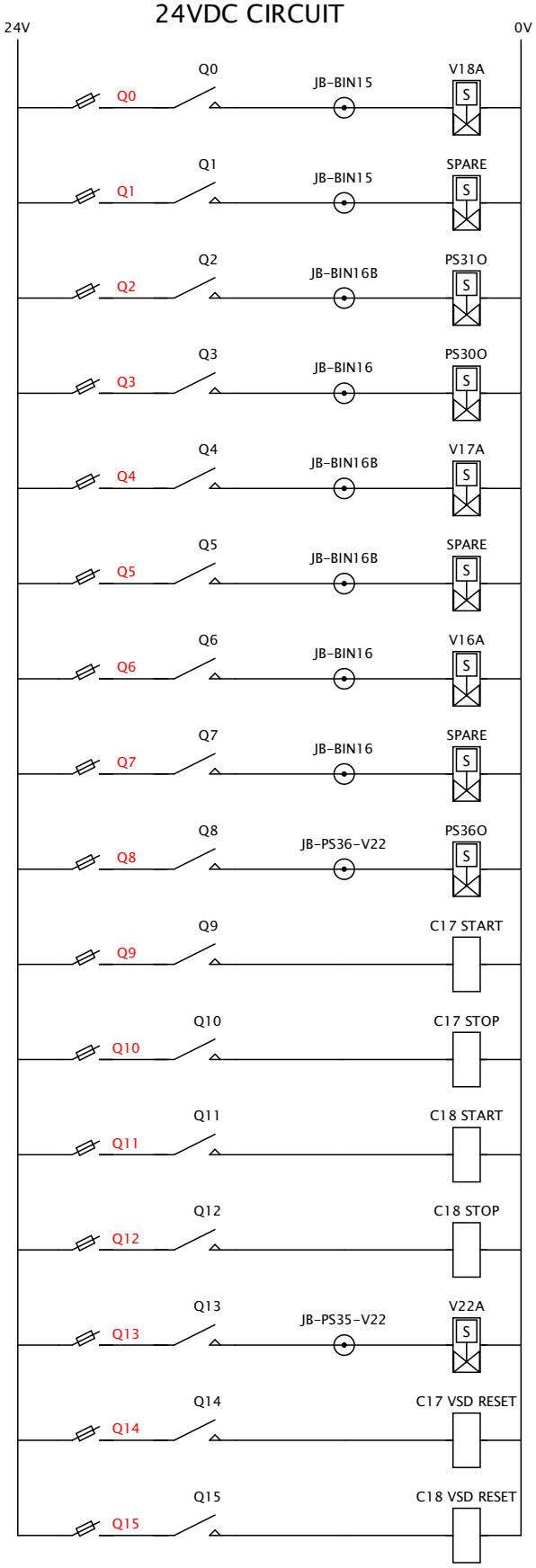
RIO 1 OUTPUT CARD 2



24VDC CIRCUIT



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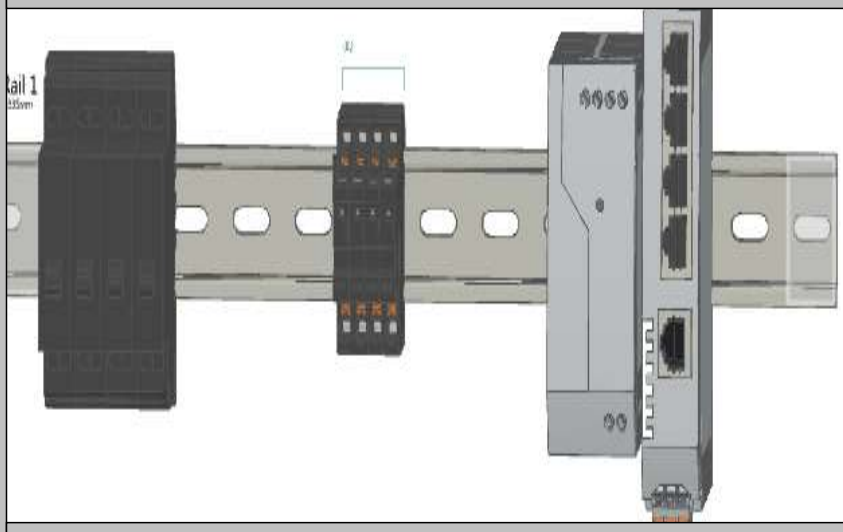
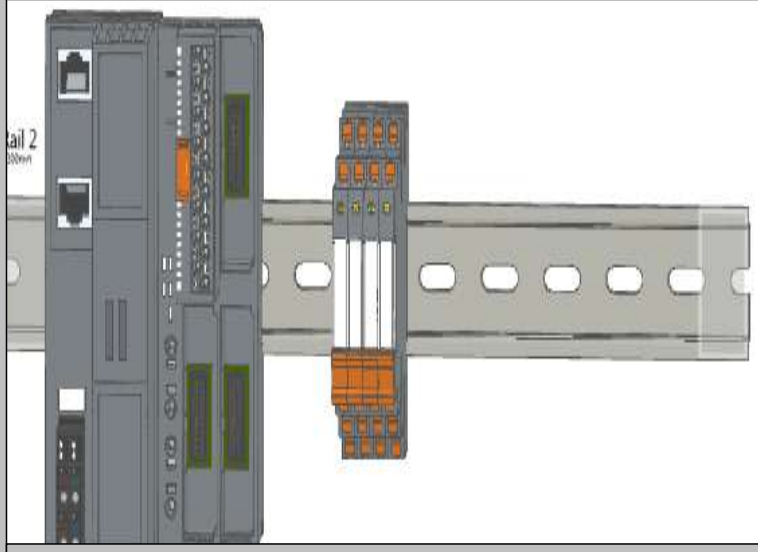
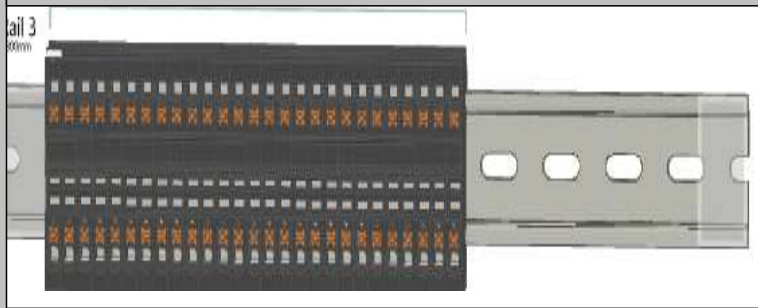
RIO 2







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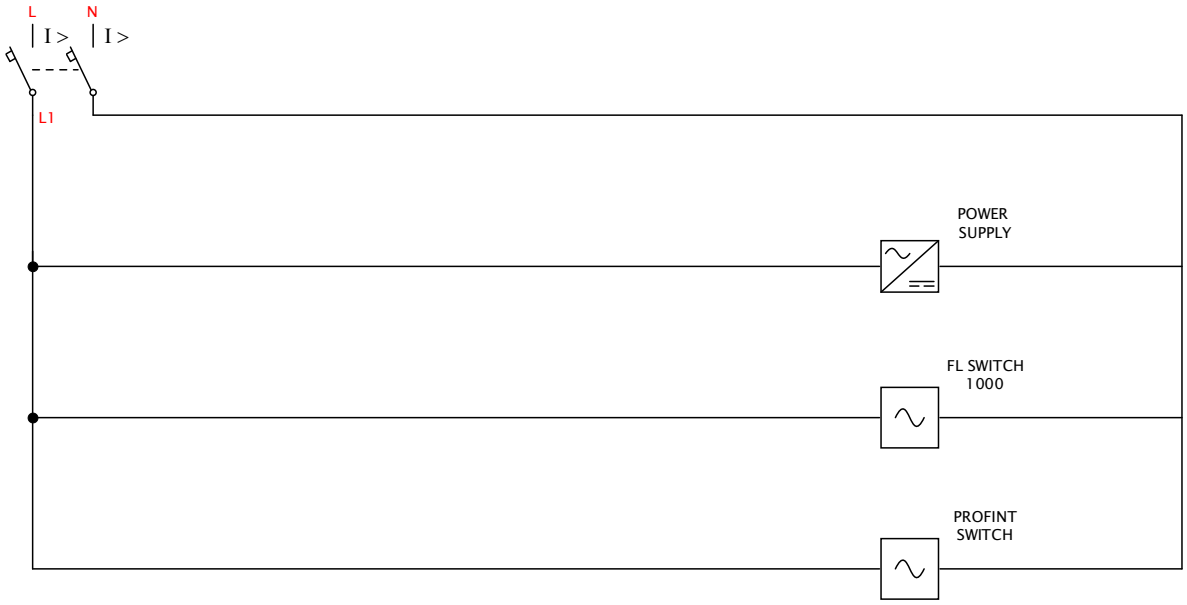
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 2 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **11/42**

RIO 2

Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 2 PICTURE** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **12/42**

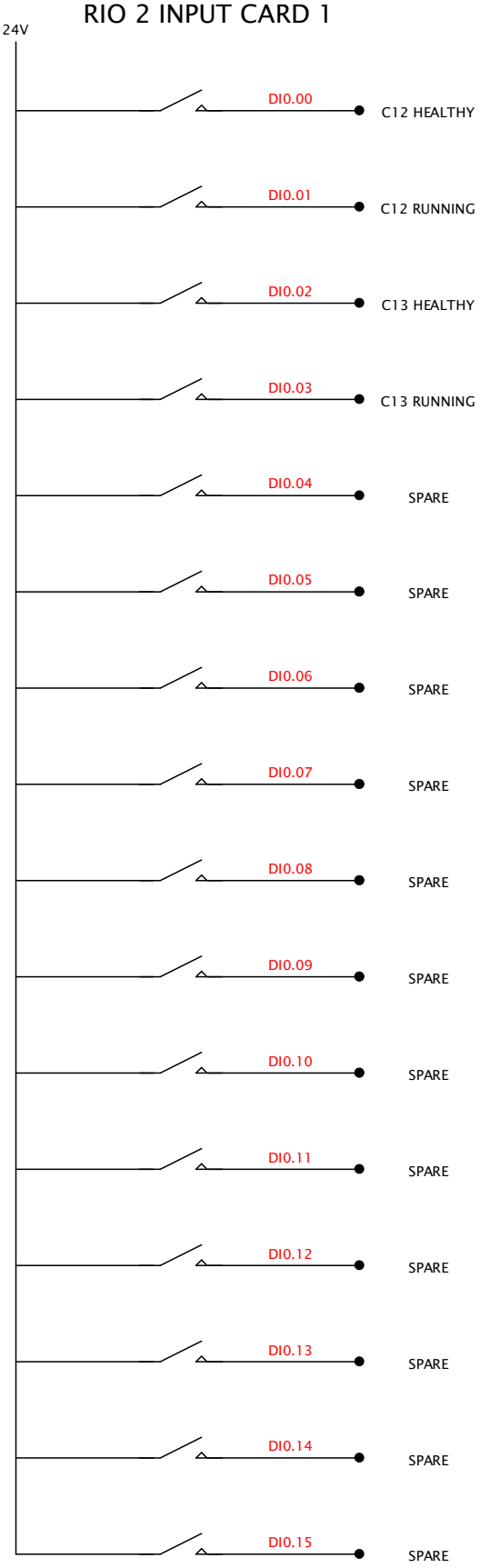
RIO2 230V Control

SUPPLY
FED FROM
2ND FLOOR MCC
CUBICLE 3

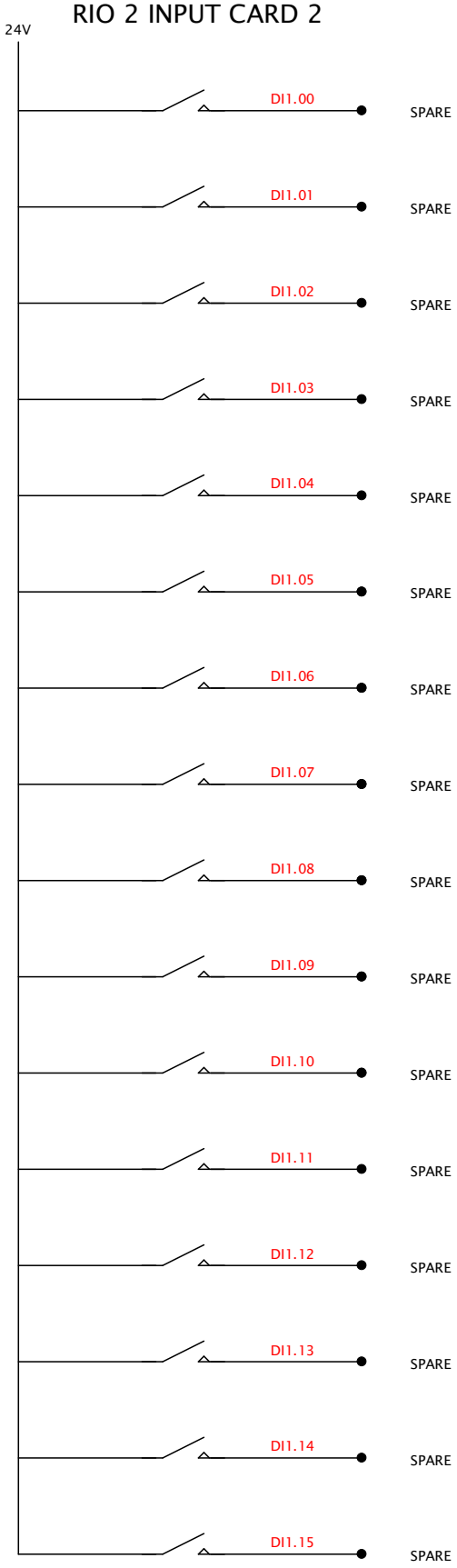


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 2 230V CONTROL** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **13/42**

RIO 2 INPUT CARD 1

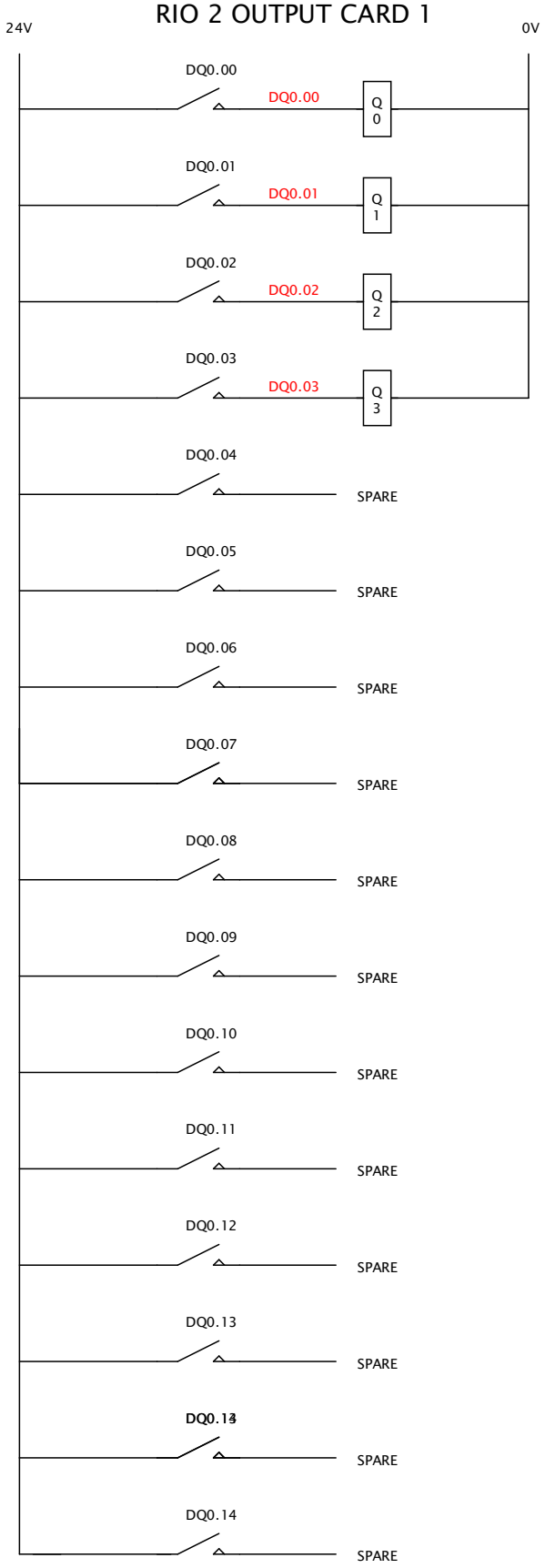


RIO 2 INPUT CARD 2

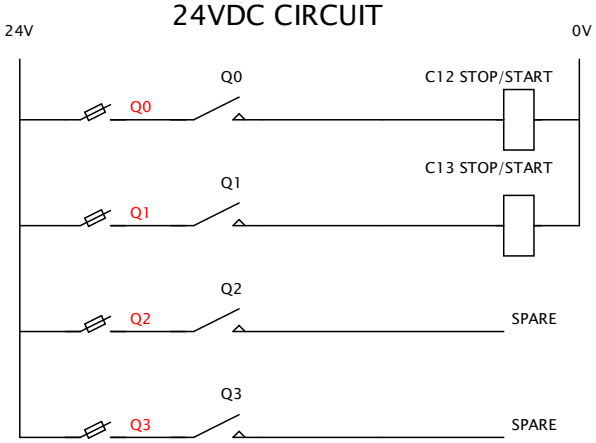


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 2 INPUT CARD 1/2** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **14/42**

RIO 2 OUTPUT CARD 1

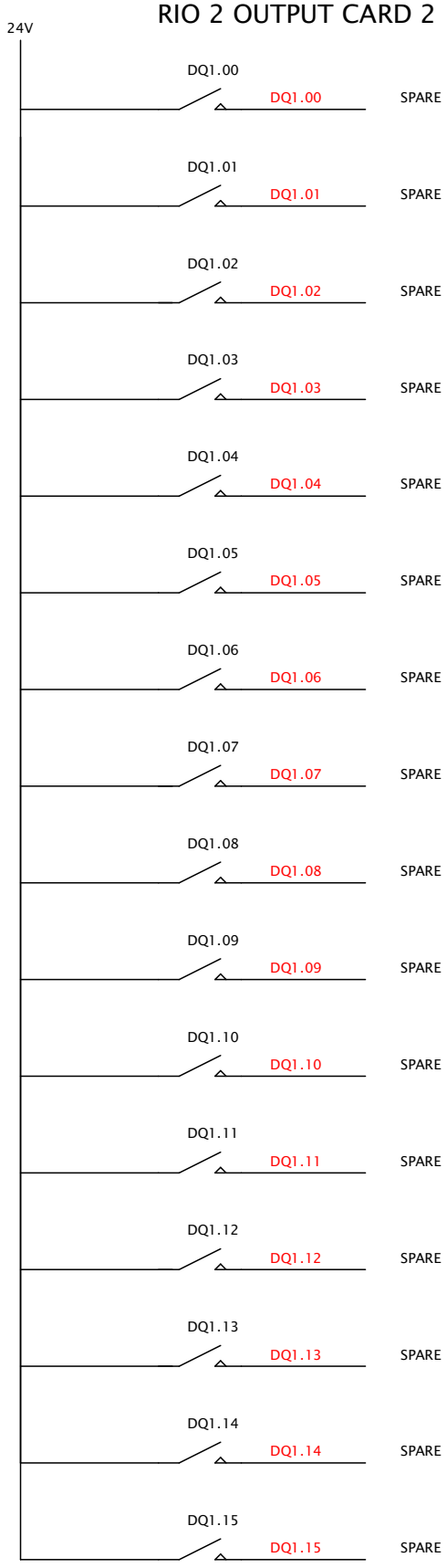


24VDC CIRCUIT



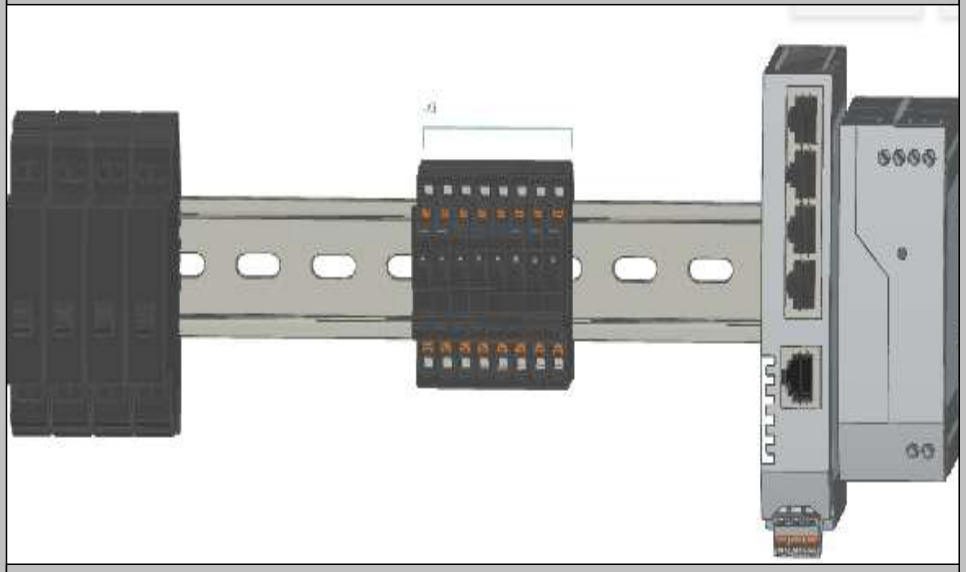
Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 2 OUTPUT CARD 1** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **15/42**

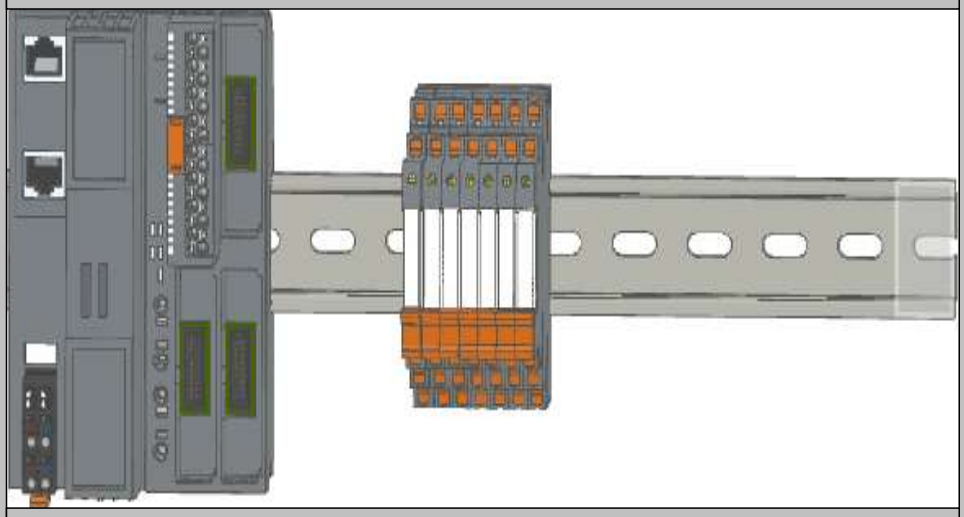
RIO 2 OUTPUT CARD 2



Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 2 OUTPUT CARD 2** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **16/42**

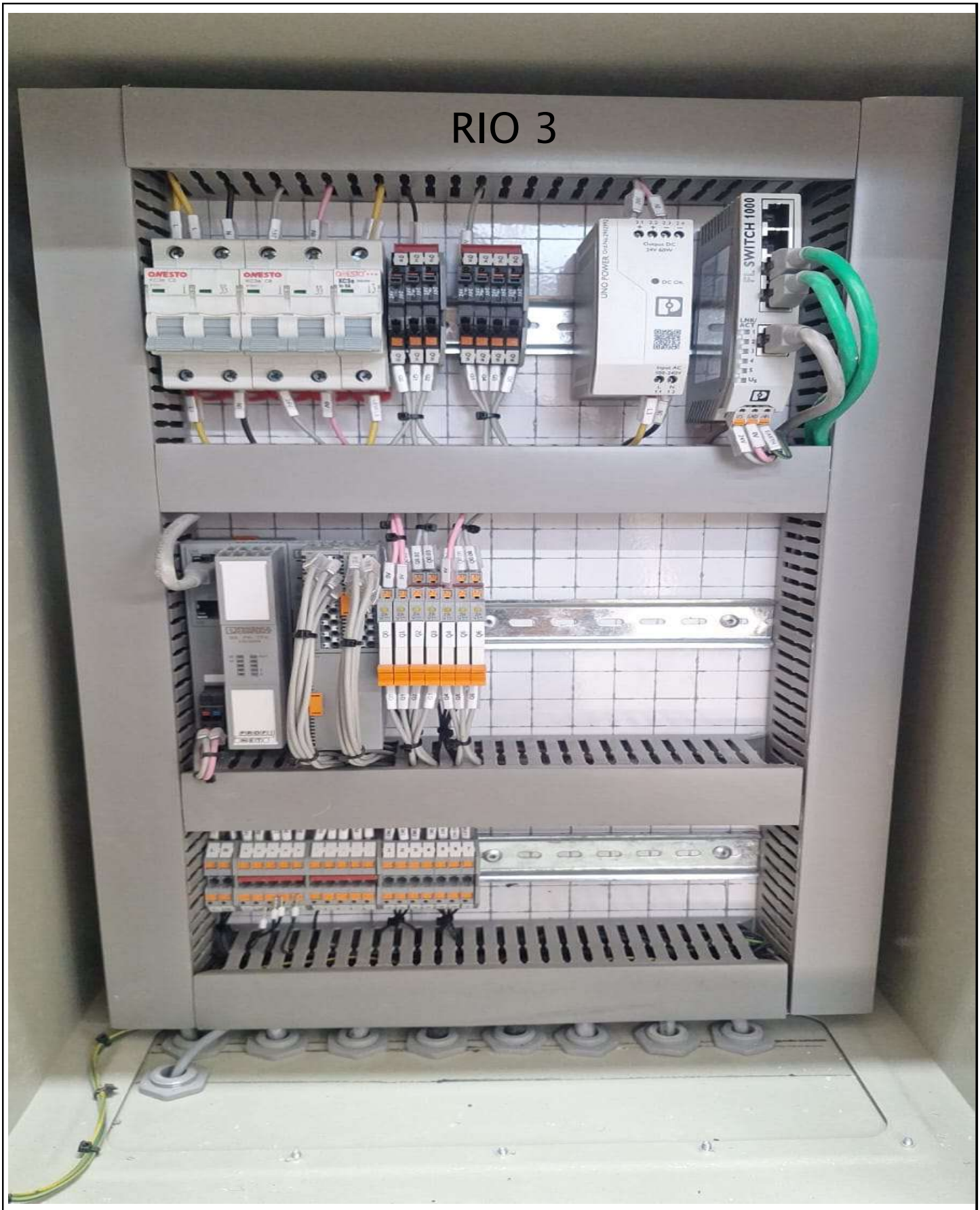
RIO 3





Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 3 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **17/42**

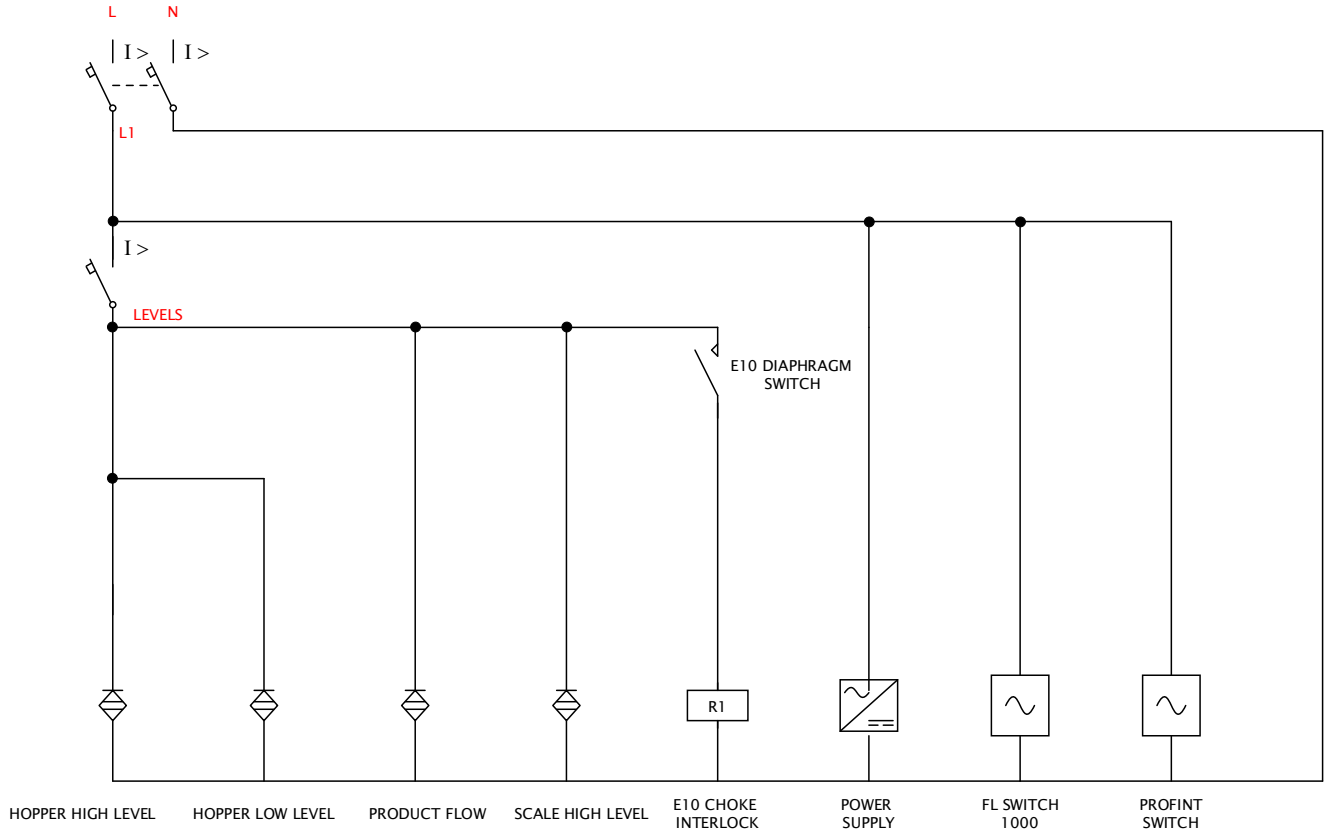
RIO 3



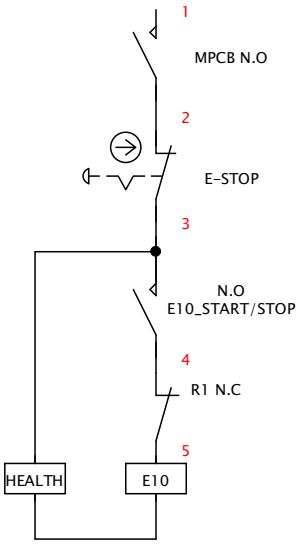
Responsible dep.	Technical reference	Created	Approved	
ENGINEERING	**TRANSFER SYSTEM**	**MARTIN ERASMUS**	**PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 3 PICTURE PIETERMARITZBURG**	Scale	
			Date of issue **2025/08/06**	Lang. / Sheet **18/42**

RIO 3 230V Control

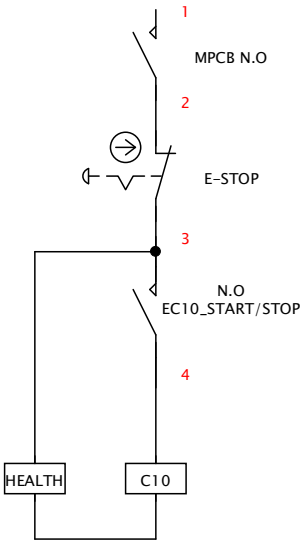
SUPPLY
FED FROM
MCC03



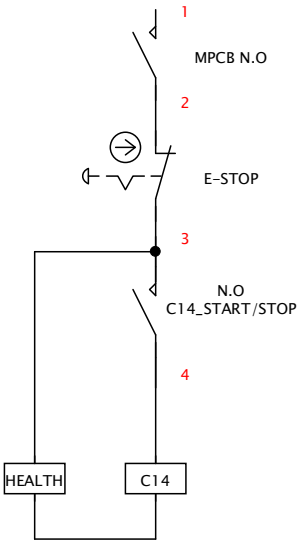
E10 CONTROL



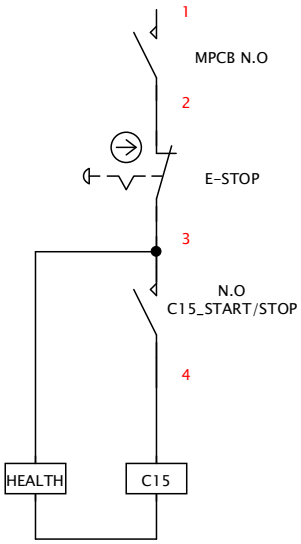
C10 CONTROL



C14 CONTROL

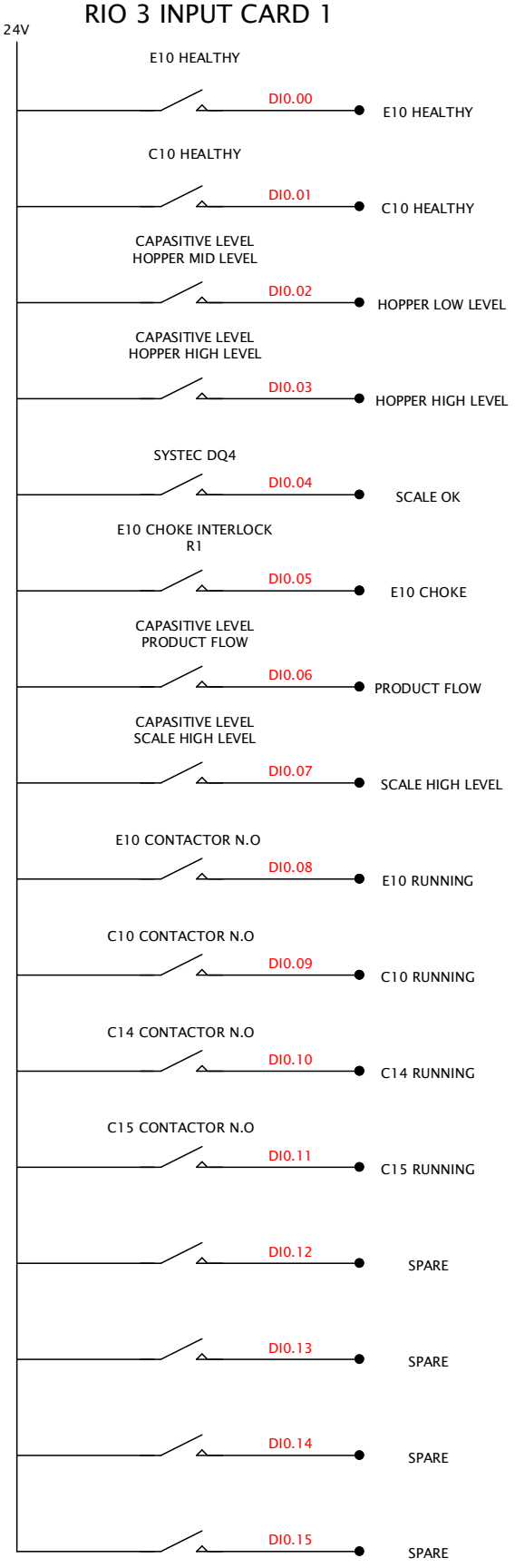


C15 CONTROL

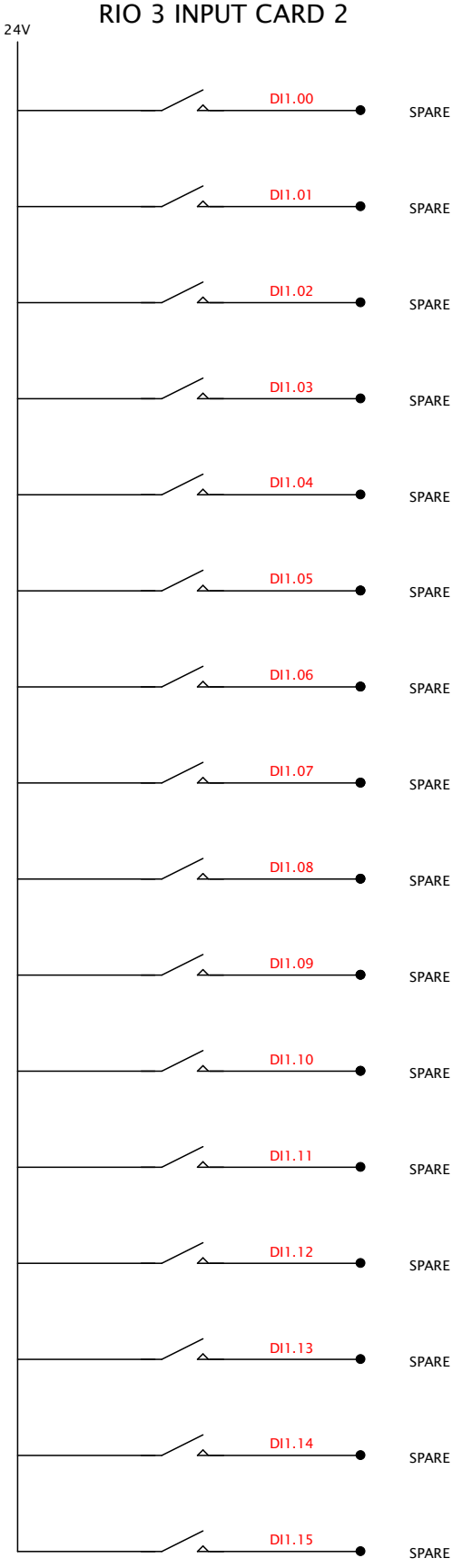


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 3 230V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **19/42**

RIO 3 INPUT CARD 1

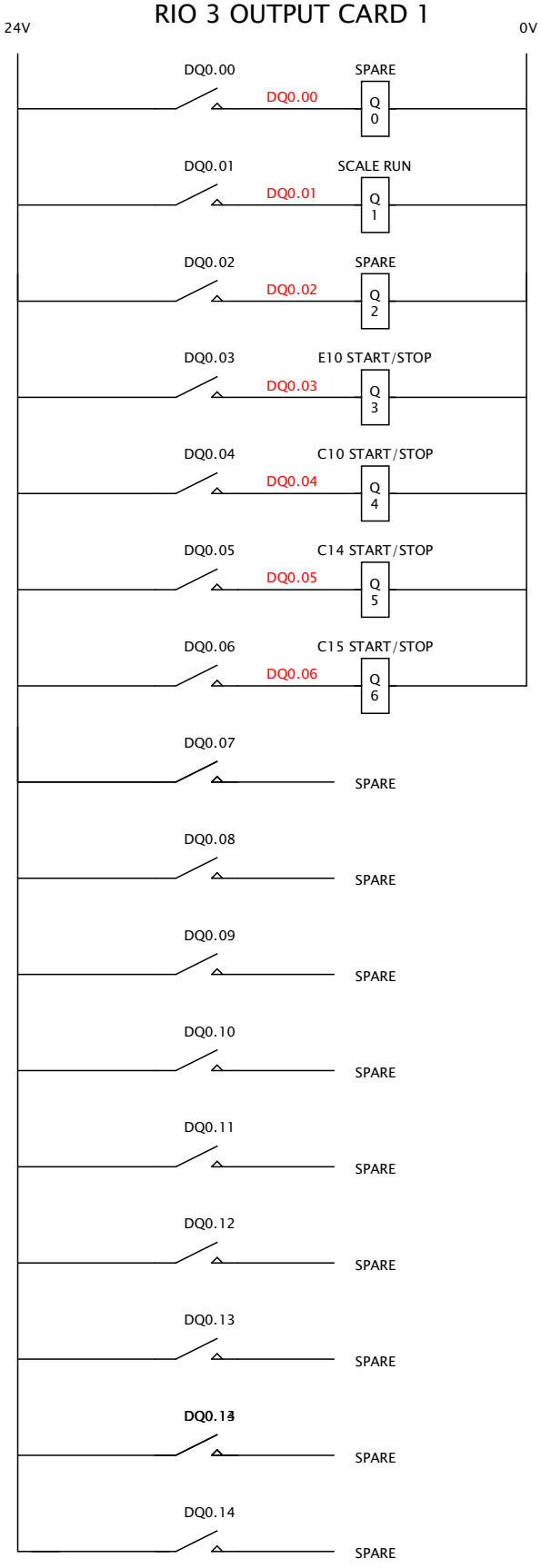


RIO 3 INPUT CARD 2

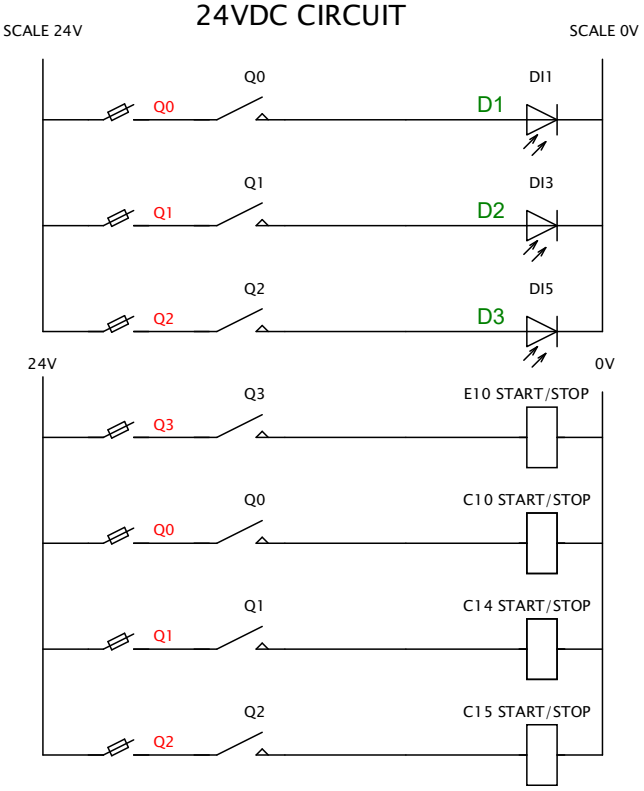


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 3 INPUT CARD 1/2** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **20/42**

RIO 3 OUTPUT CARD 1

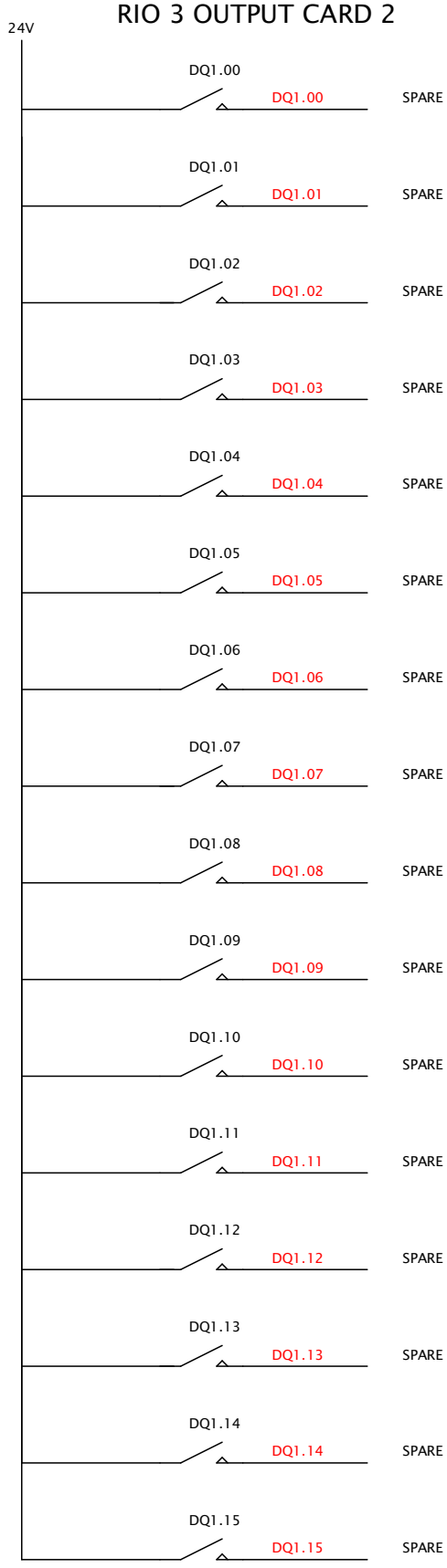


24VDC CIRCUIT



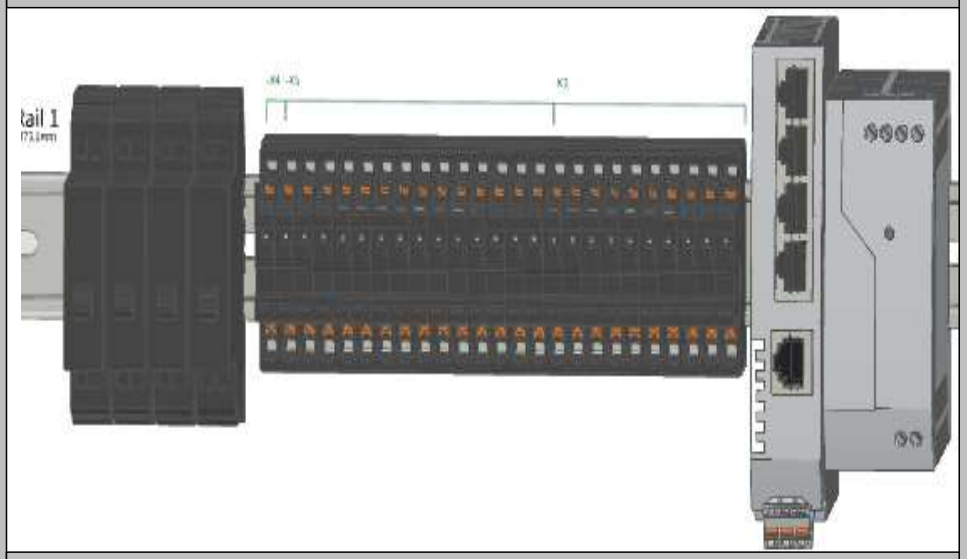
Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 3 OUTPUT CARD 1** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **21/42**

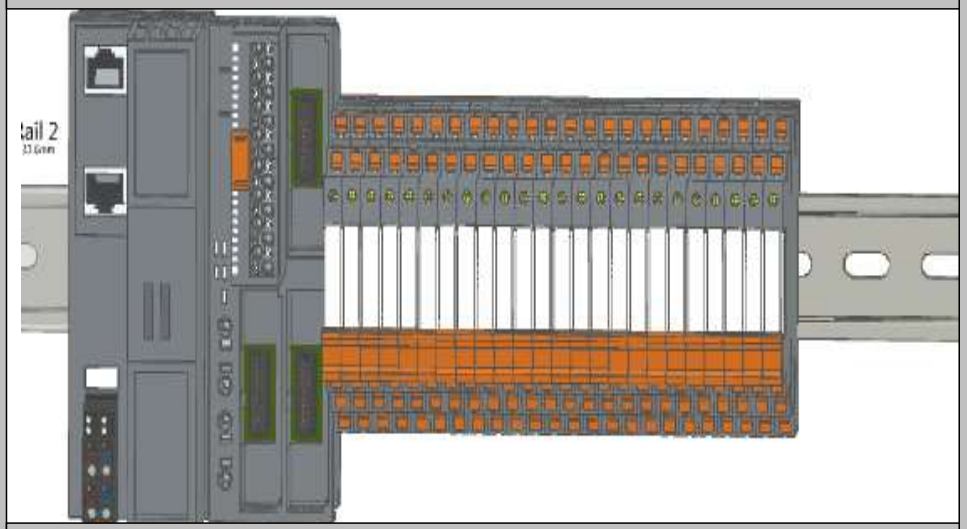
RIO 3 OUTPUT CARD 2

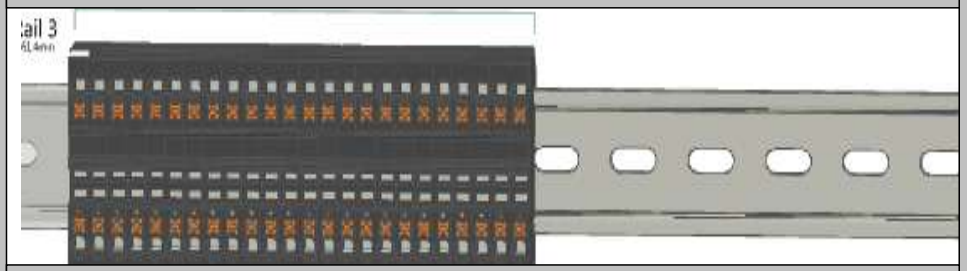


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 3 OUTPUT CARD 2** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **22/42**

RIO 4

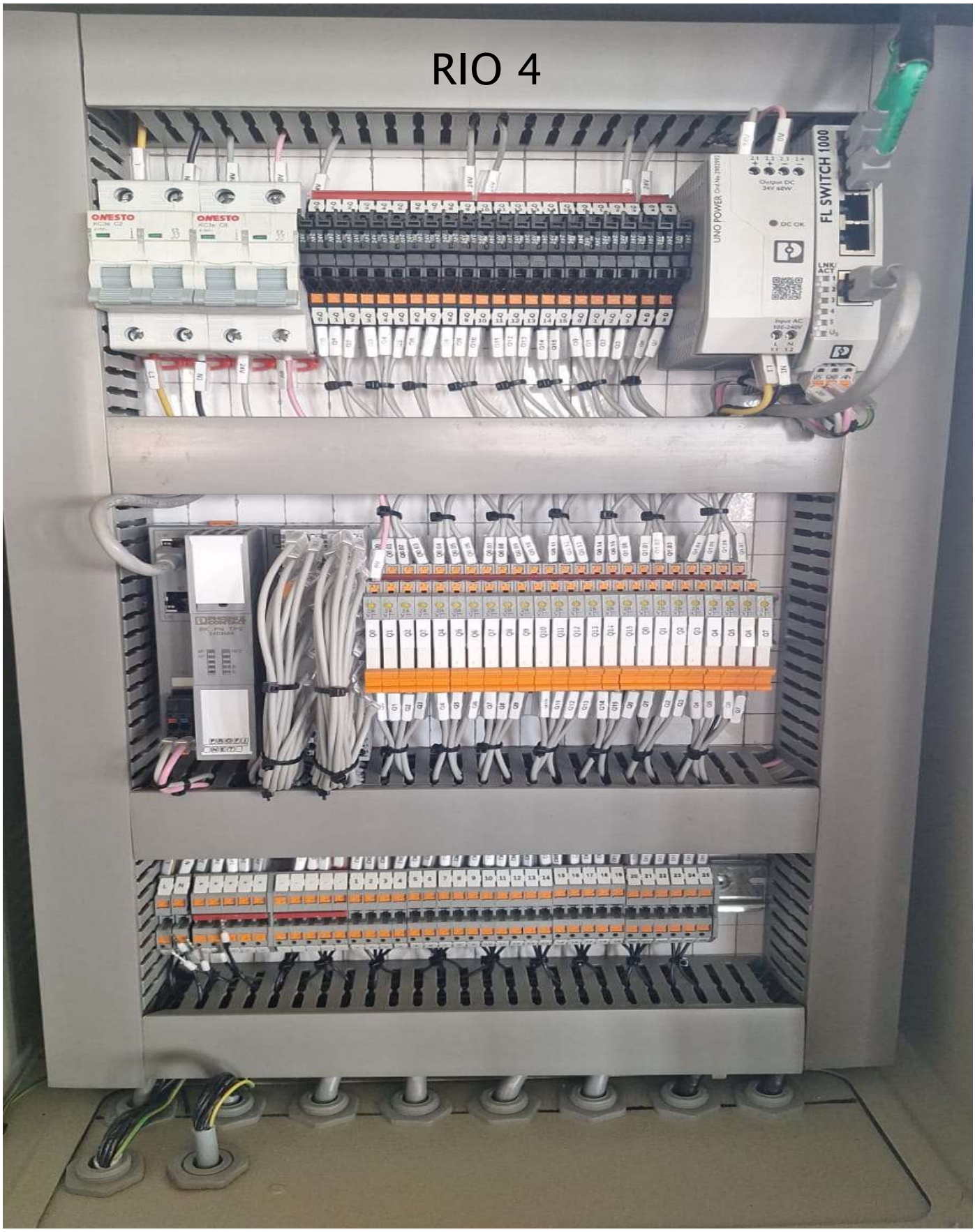






Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **23/42**

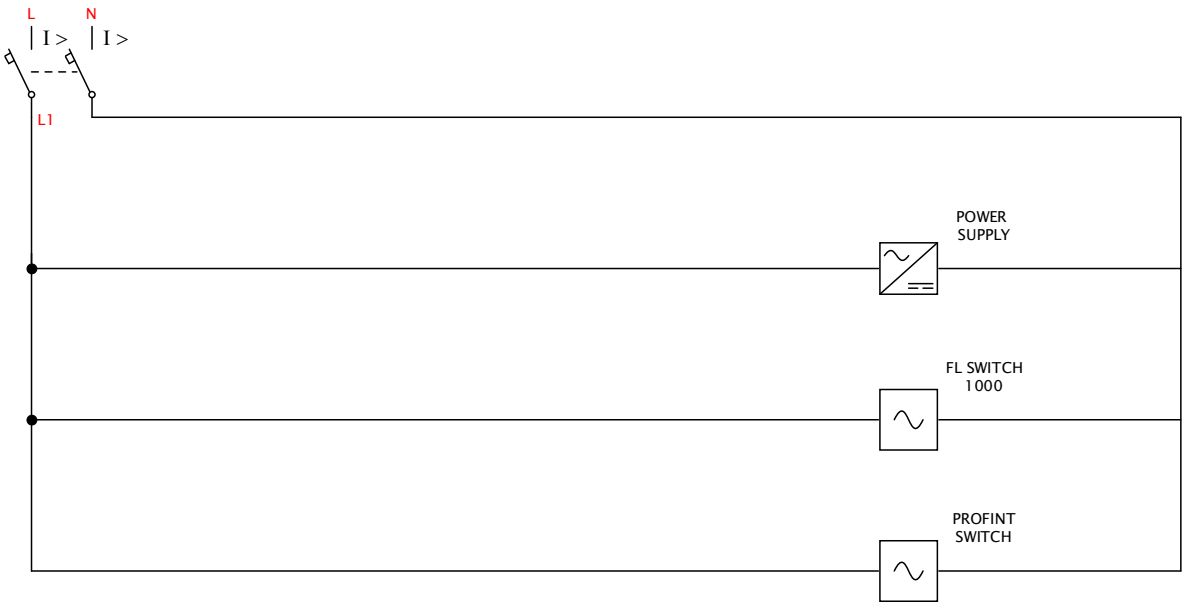
RIO 4



Responsible dep.	Technical reference	Created	Approved		
ENGINEERING	**TRANSFER SYSTEM**	**MARTIN ERASMUS**	**PENDING**		
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**		Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 PICTURE** **PIETERMARITZBURG**		Scale	
			Date of issue **2025/08/06**	Lang.	Sheet **24/42**

RIO4 230V Control

SUPPLY
FED FROM
C4 VSD PANEL

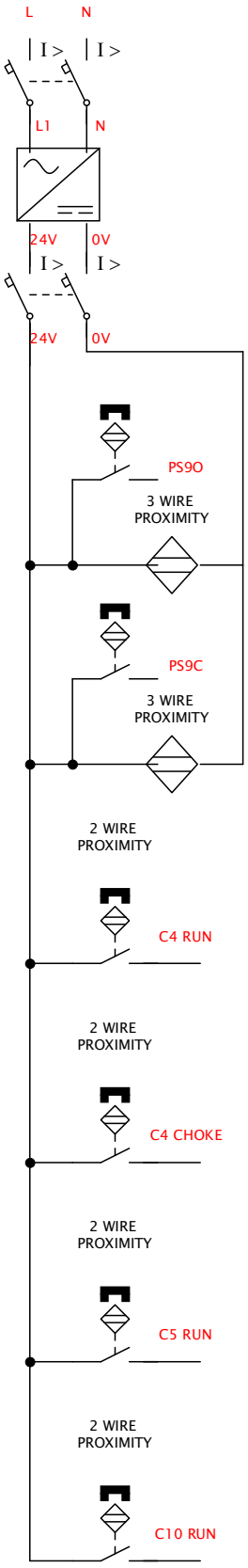


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 230V CONTROL** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **25/42**

RIO4 24V Control

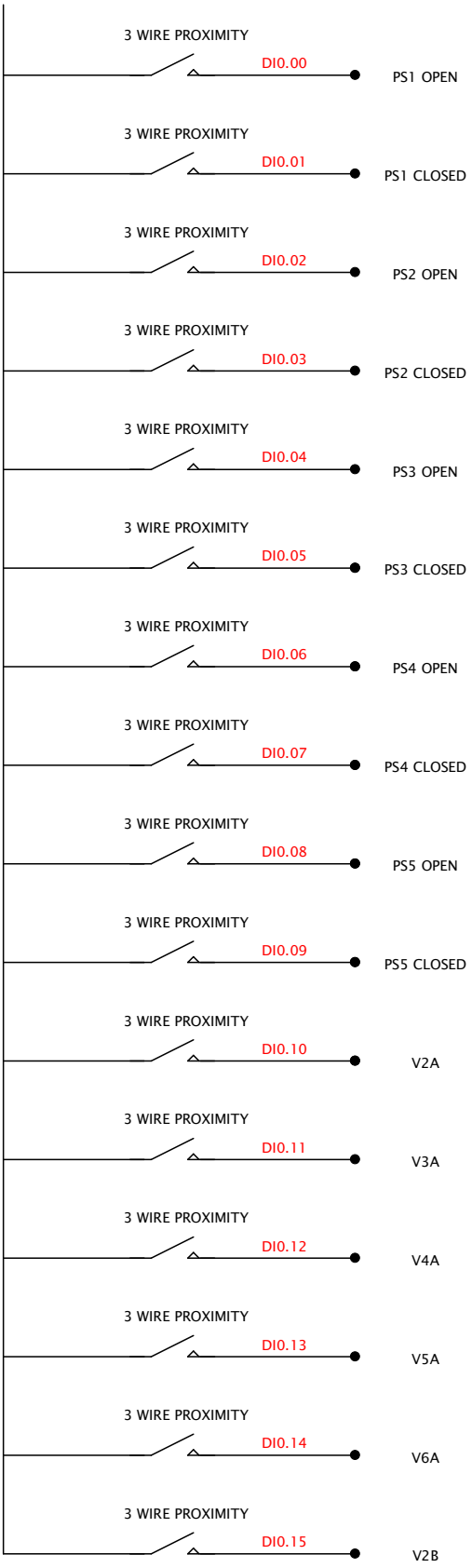
Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 24V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **26/42**

RIO4 24V Control

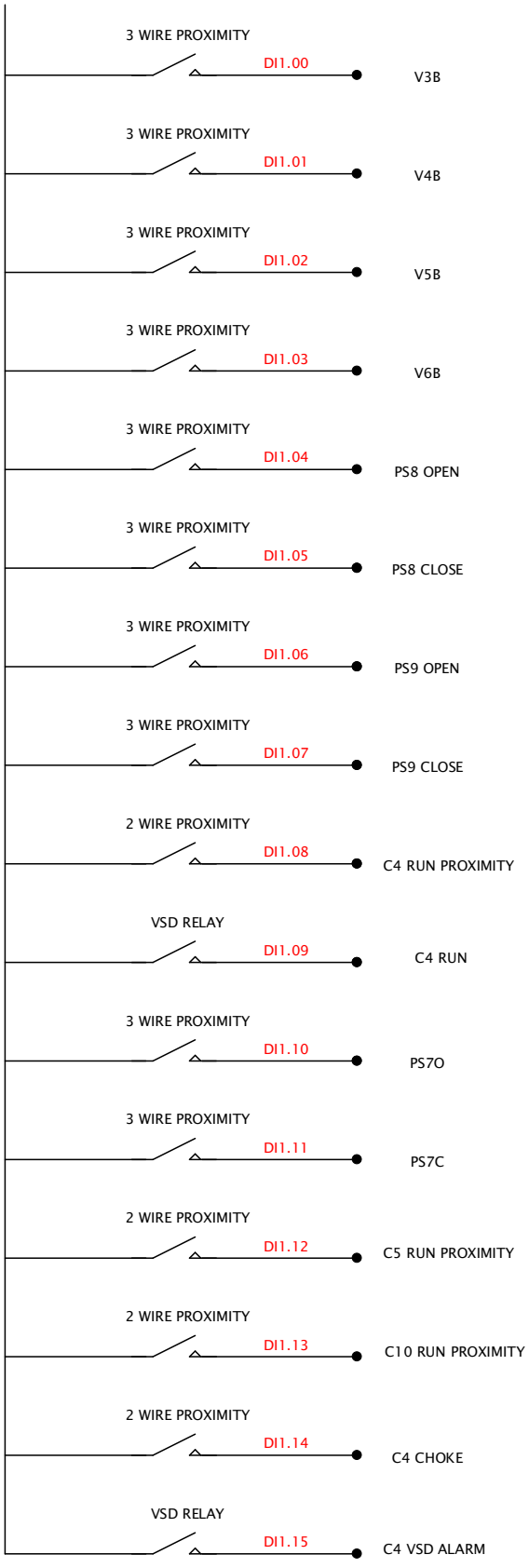


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 24V CONTROL** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **27/42**

RIO 4 INPUT CARD 1

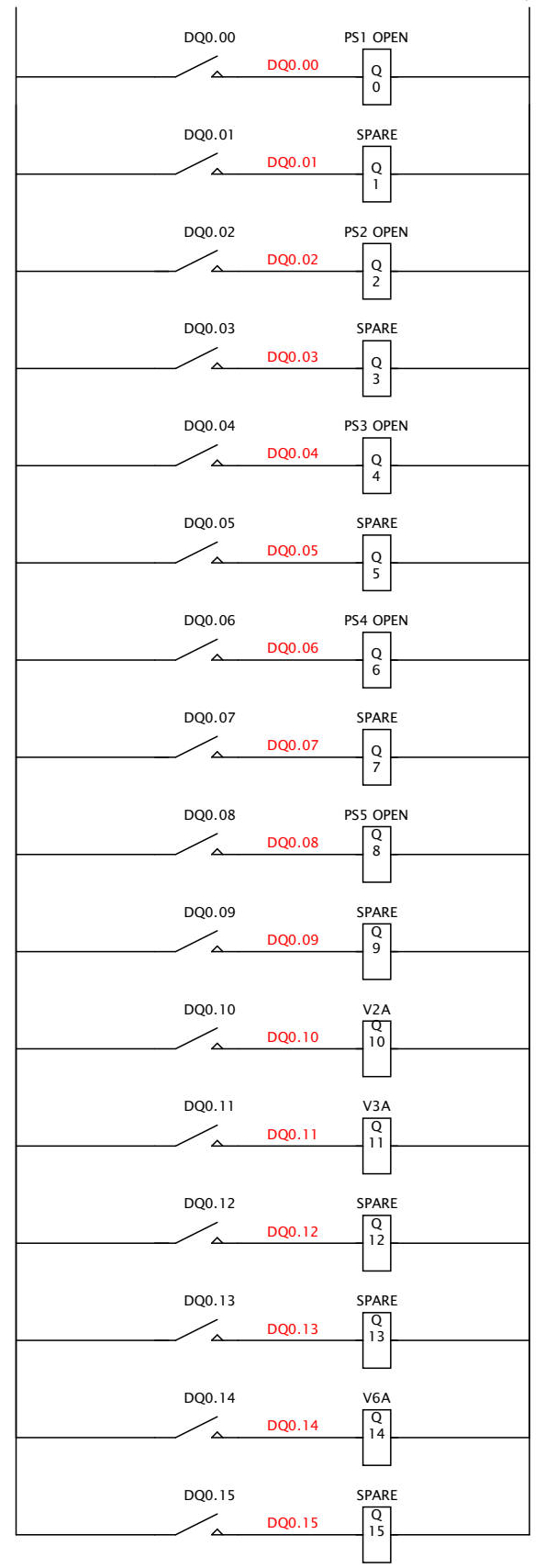


RIO 4 INPUT CARD 2

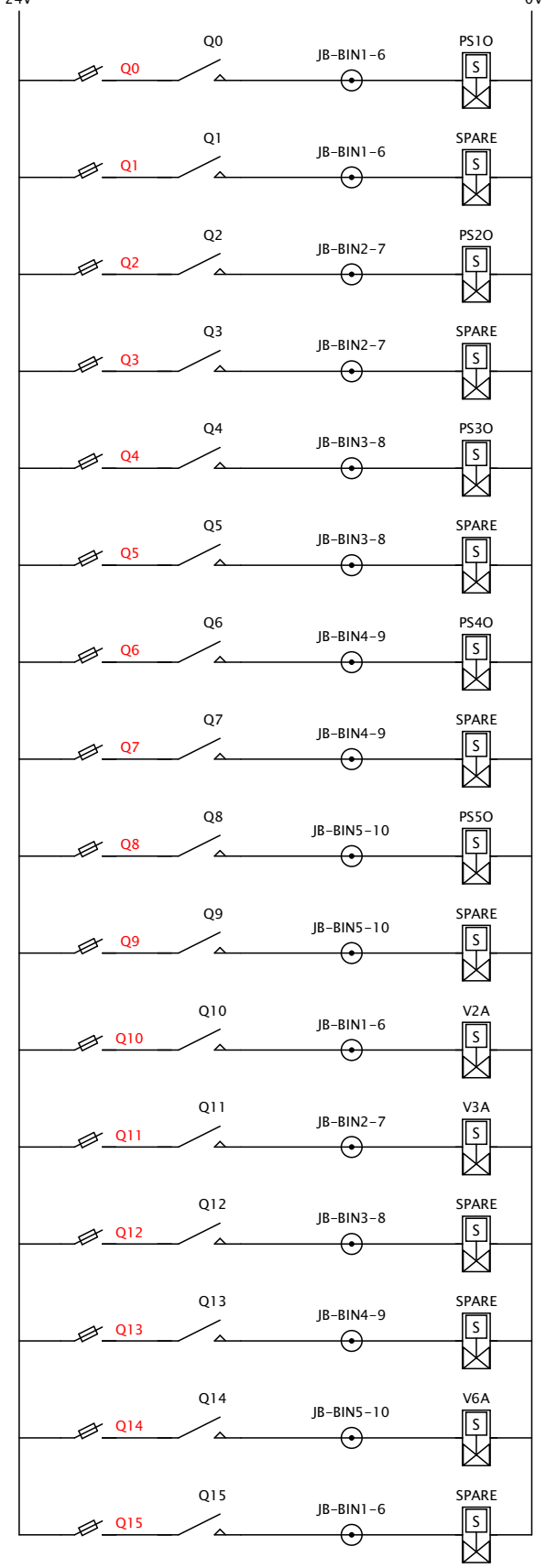


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 INPUT CARD 1/2** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **28/42**

RIO 4 OUTPUT CARD 1

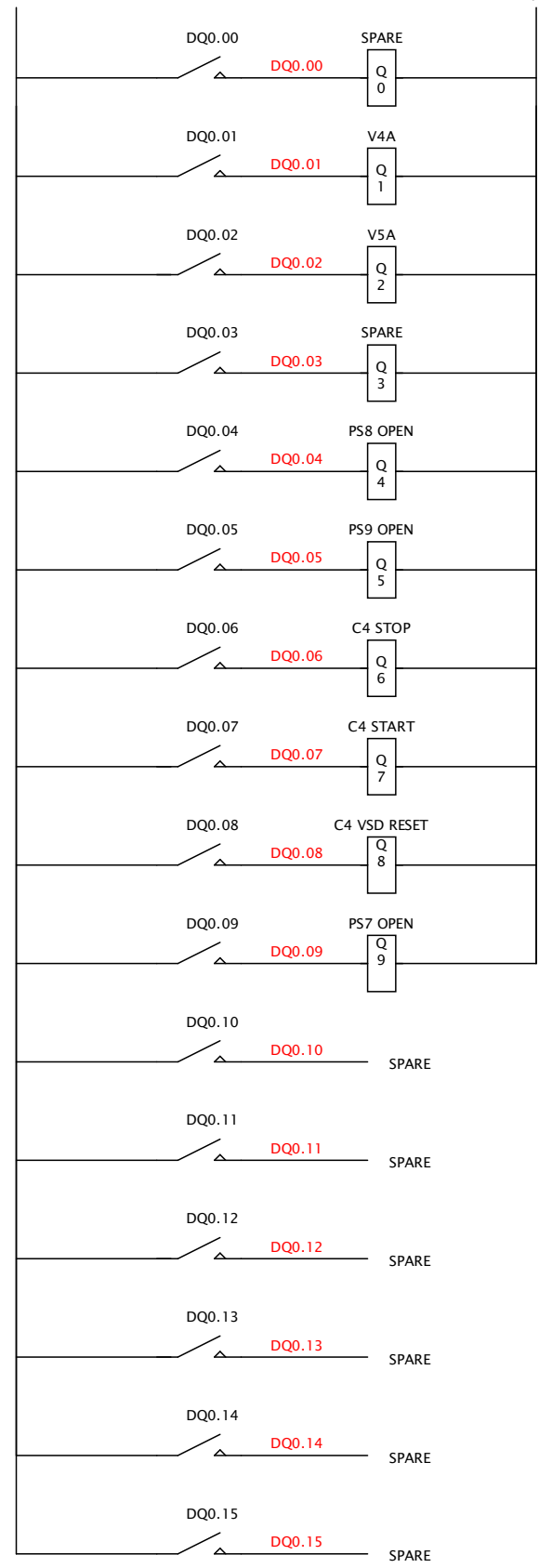


24VDC CIRCUIT

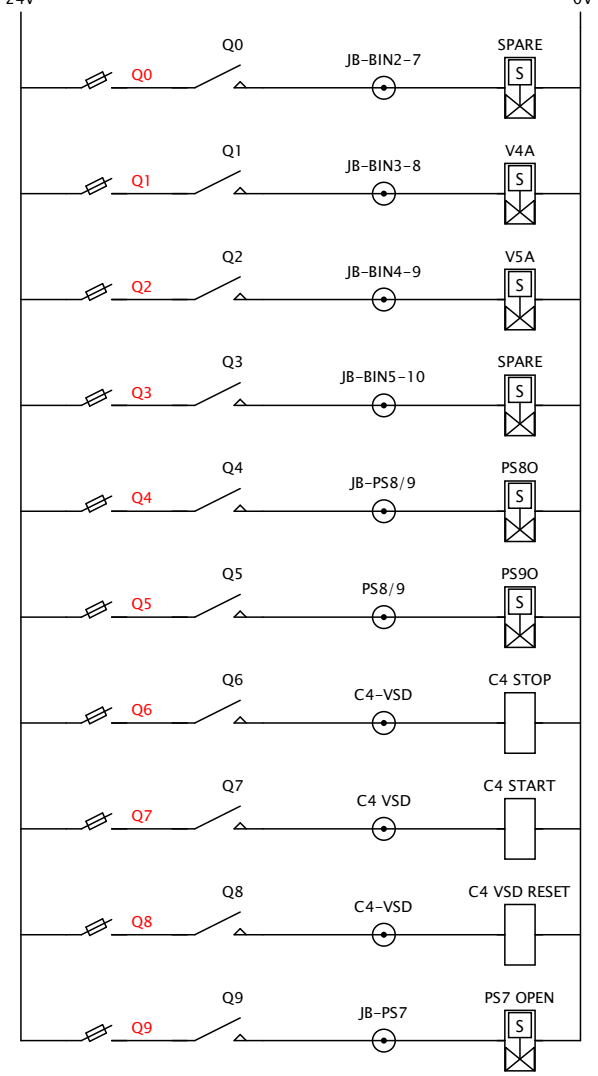


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 OUTPUT CARD 1** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **29/42**

RIO 4 OUTPUT CARD 2



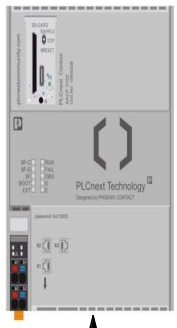
24VDC CIRCUIT



Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **RIO 4 OUTPUT CARD 2** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **30/42**

AFGRI NETWORK
IP:192.168.2.11

AXC F 3152 SILO MCC
IP:10.71.71.2



EWON COSY
IP:10.71.71.100

ANIMAL FEEDS
CONTROL ROOM
IP:10.71.71.50

RIO 4
FL SWITCH 1005N

AXL F BK PN TPS
IP:10.71.71.13

RIO 3
FL SWITCH 1005N

AXL F BK PN TPS
IP:10.71.71.12

RIO 2
FL SWITCH 1005N

AXL F BK PN TPS
IP:10.71.71.11

RIO 1
FL SWITCH 1005N

AXL F BK PN TPS
IP:10.71.71.10

Responsible dep.	Technical reference	Created	Approved	
ENGINEERING	**TRANSFER SYSTEM**	**MARTIN ERASMUS**	**PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **NETWORK LAYOUT PIETERMARITZBURG**	Scale	
			Date of issue **2025/08/06**	Lang. / Sheet **31/42**

CONTROL CB | ISOLATOR AUXILIARY | 3POLE ISOLATOR

VSD

SUPPLY | LOAD | CONTROL | PLC STOP | PLC START | VSD RESET | VSD ALARM | VSD START

Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C4 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **32/42**

SUPPLY CHARACHTERISTICS
TNS
NEUTRAL – EARTH
SEPARATE

50A
CB

I >

120A
ISOLATOR

22kW
VSD

L1 L2 L3

INVT
VSD
GD200

U V W

22kW
MOTOR

M
3~

C4-0

DOUBLE
POLE
CB

C4-1

FIELD
ISOLATOR

C4-2

E-STOP

C4-3

FIELD
STOP

C4-4

PLC
STOP

C4-5

VSD
ALARM

C4-6

1 - 2

MAN
AUTO

C4-7

C4-9

FIELD
START

N.O
R5

PLC
START

N.O
R5

VSD
RELAY

N.O
R4

N.O
R5

C4-8

C4-10

C4-11

C4-12

R5

R4

VSD
START

VSD
ALARM

VSD
TRIP

EXTRACTION
FAN

VSD
RUN

Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
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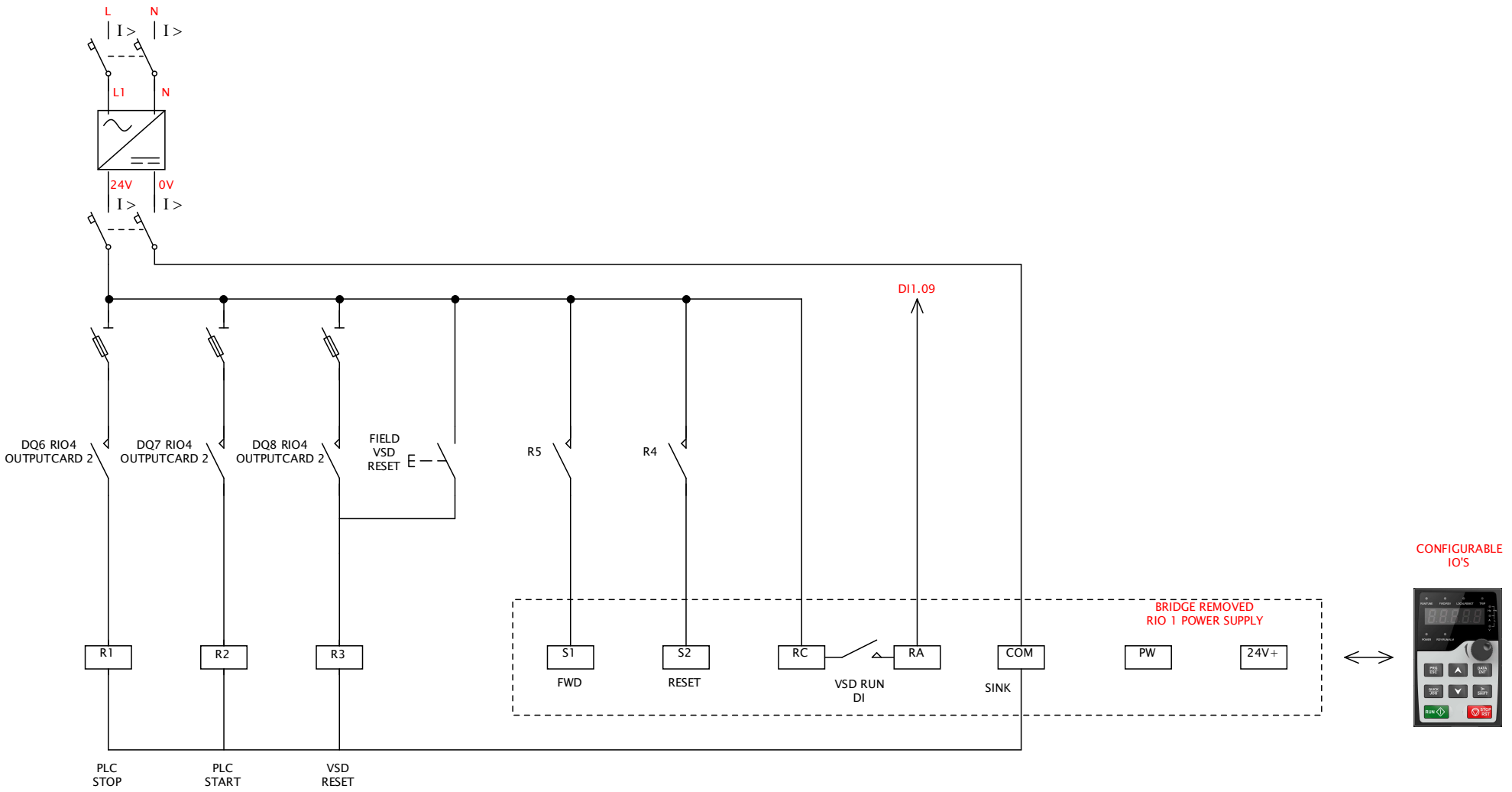
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C4 MAIN AND 230V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **33/42**



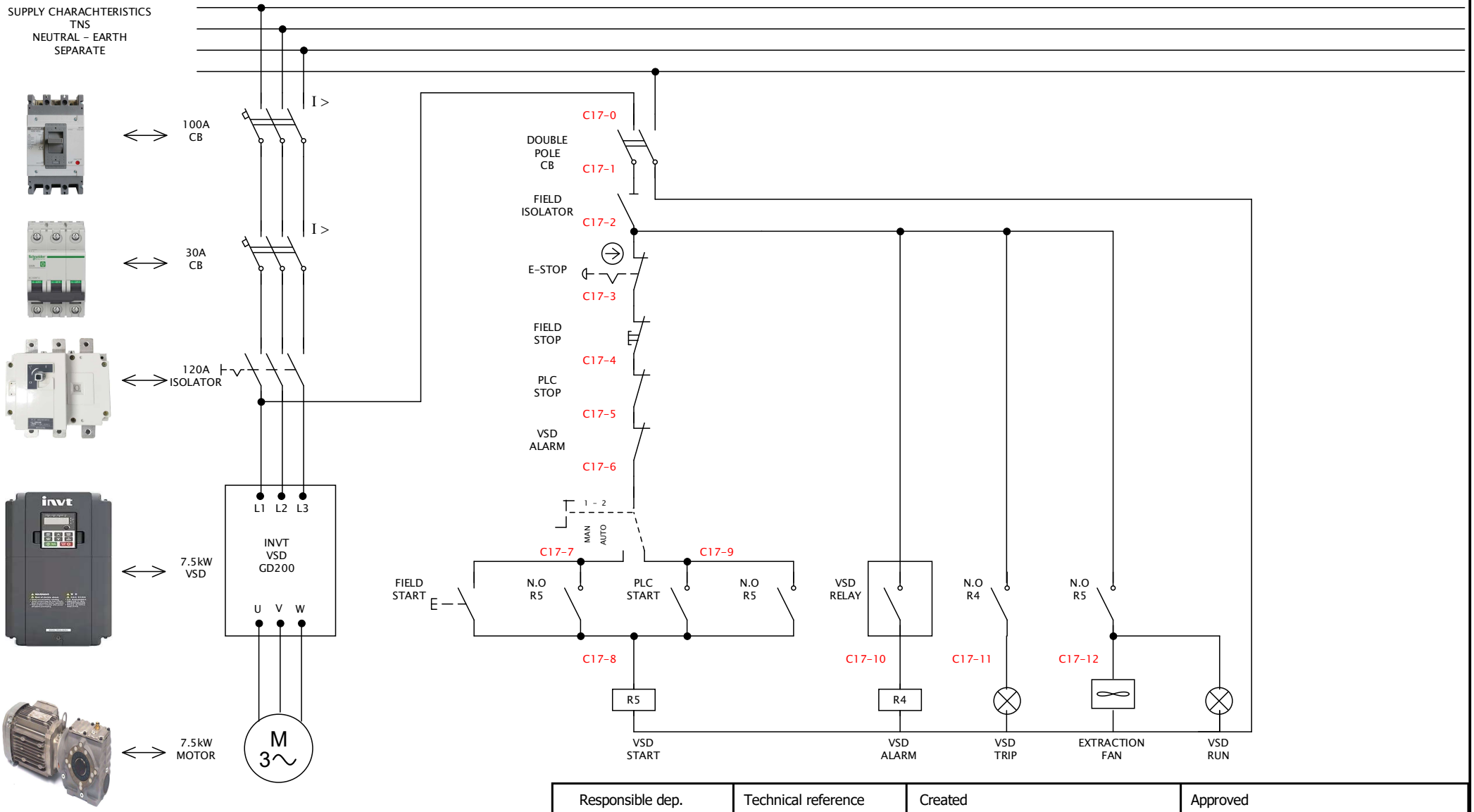
Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C4 24V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **34/42**

CONTROL CB | ISOLATOR AUXILIARY | 3POLE ISOLATOR

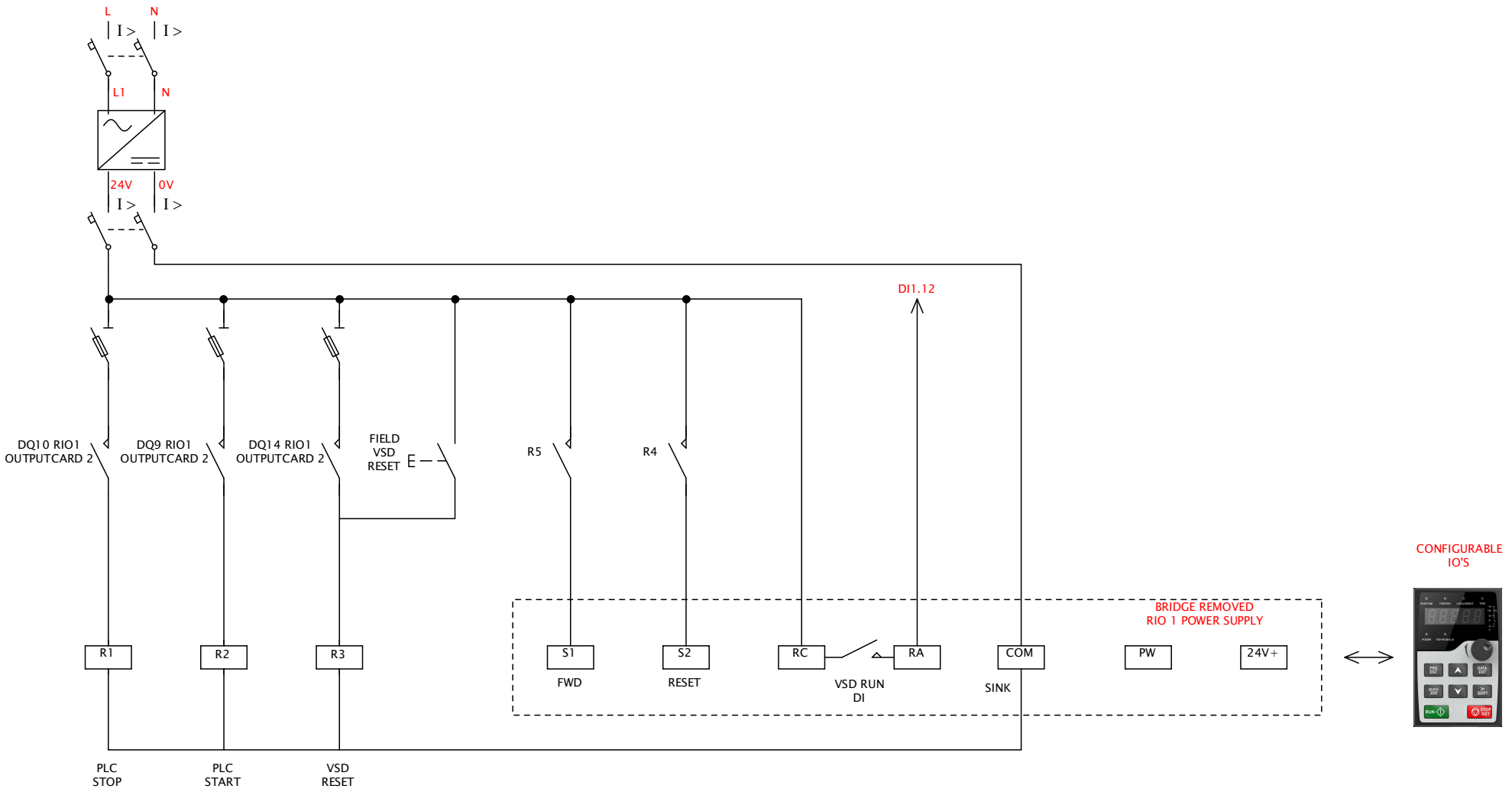
VSD

SUPPLY | LOAD | CONTROL | PLC STOP | PLC START | VSD RESET | VSD ALARM | VSD START

Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C17 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **35/42**



Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C17 MAIN AND 230V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **36/42**



Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C17 24V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **37/42**

CONTROL CB | ISOLATOR AUXILIARY | 3POLE ISOLATOR

VSD

SUPPLY | LOAD | CONTROL | PLC STOP | PLC START | VSD RESET | VSD ALARM | VSD START

Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
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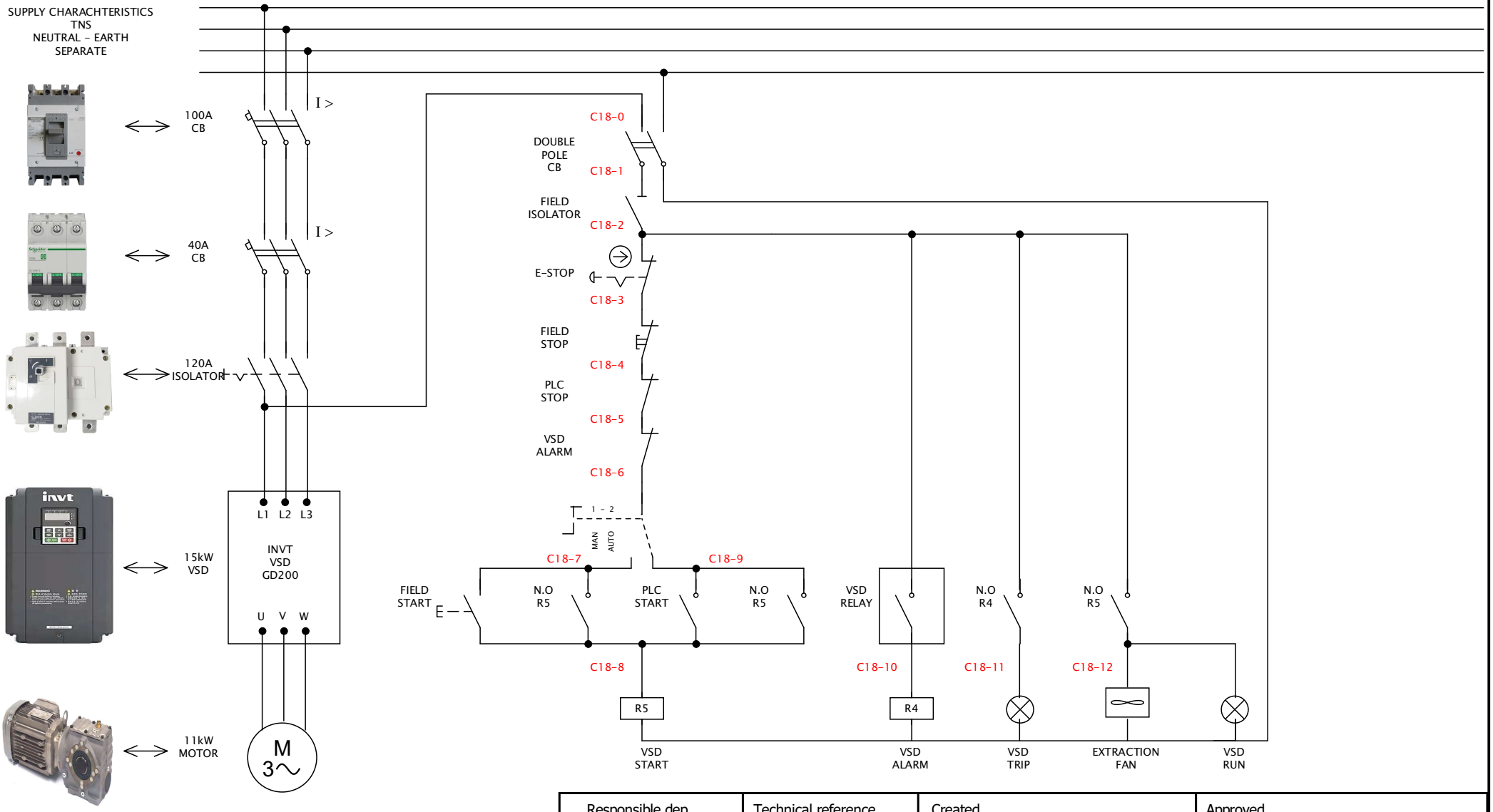
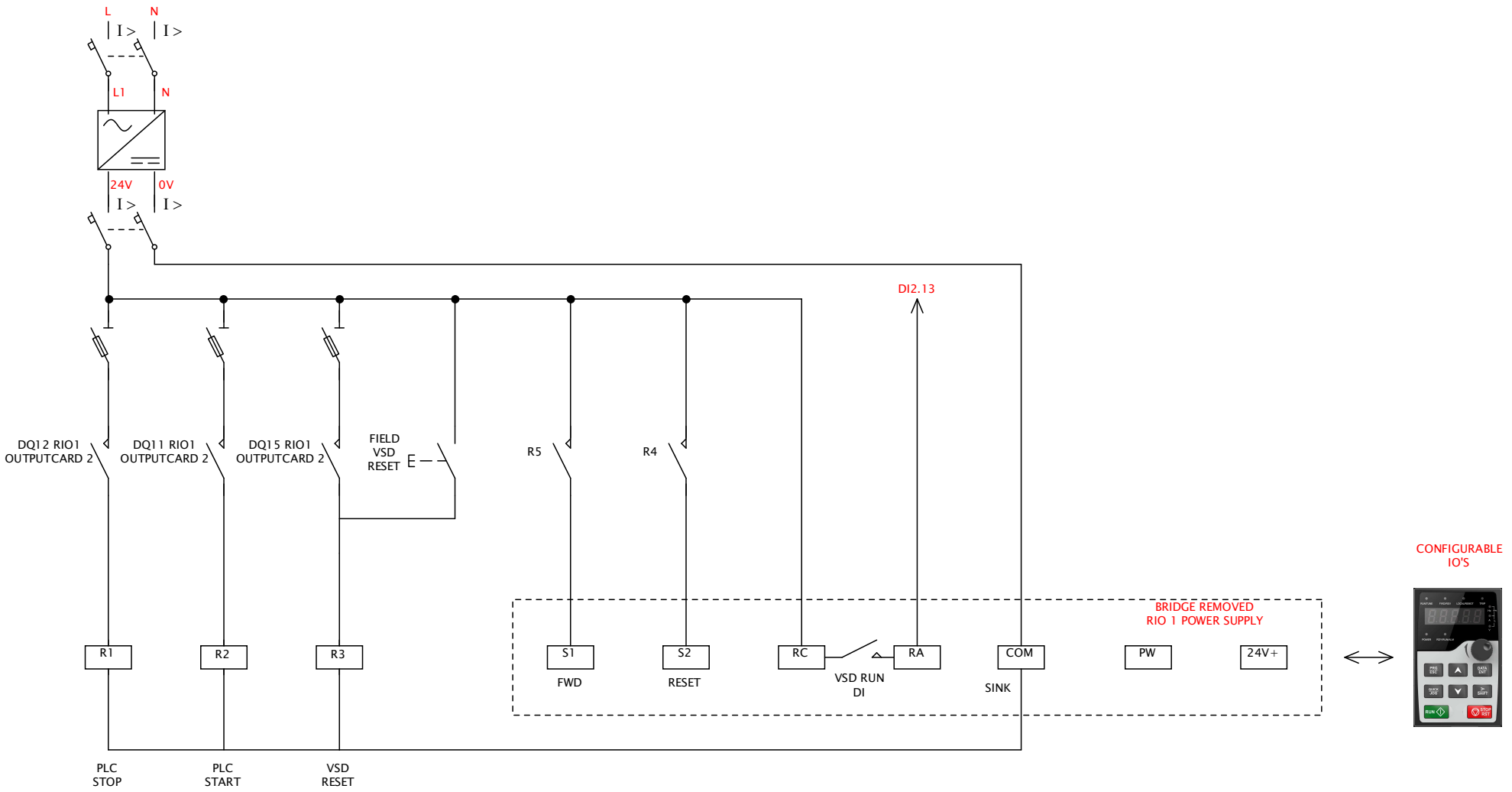
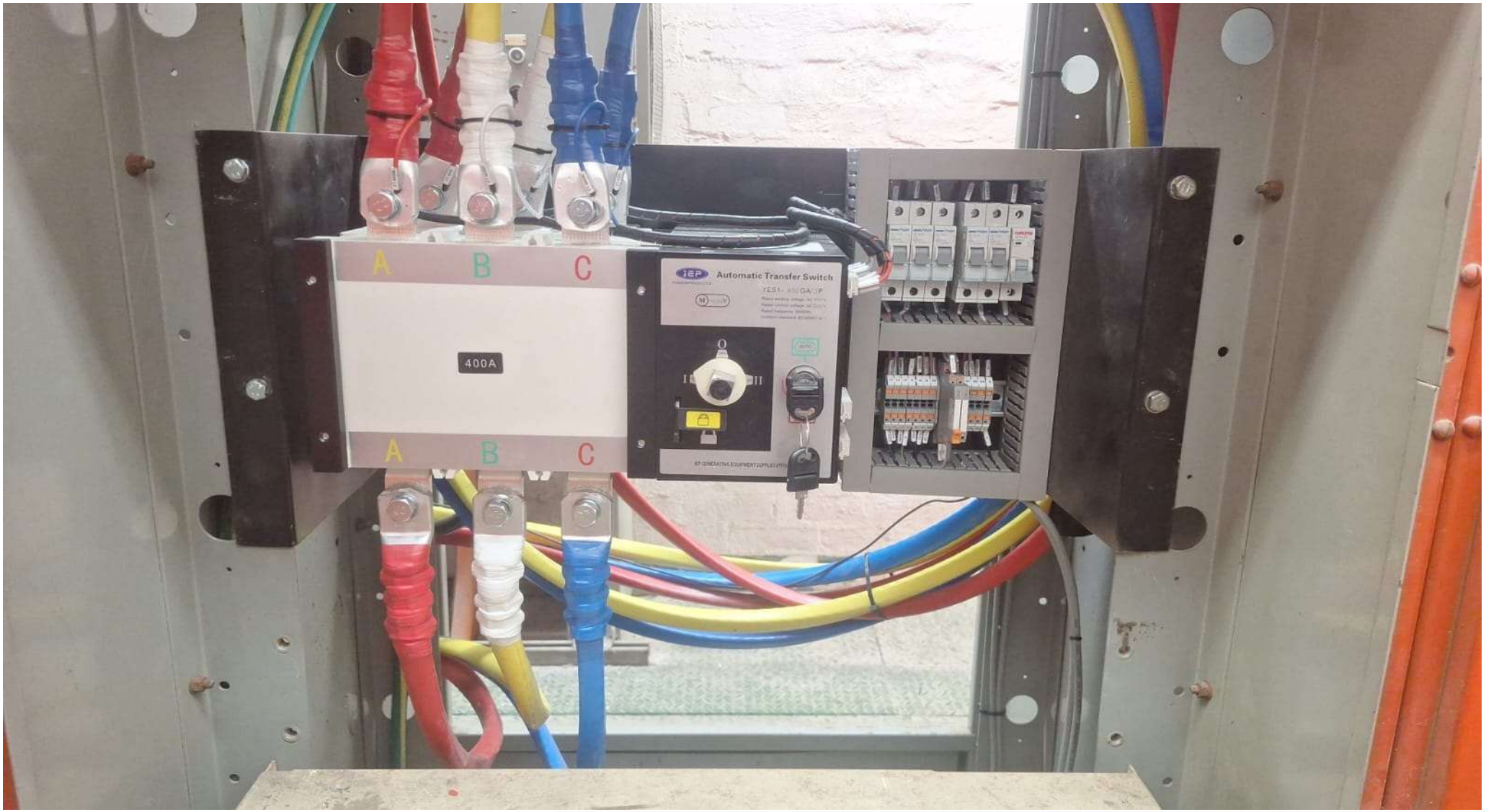
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C18 LAYOUT** **PIETERMARITZBURG**	Date of issue **2025/08/06**	Scale Lang. Sheet **38/42**



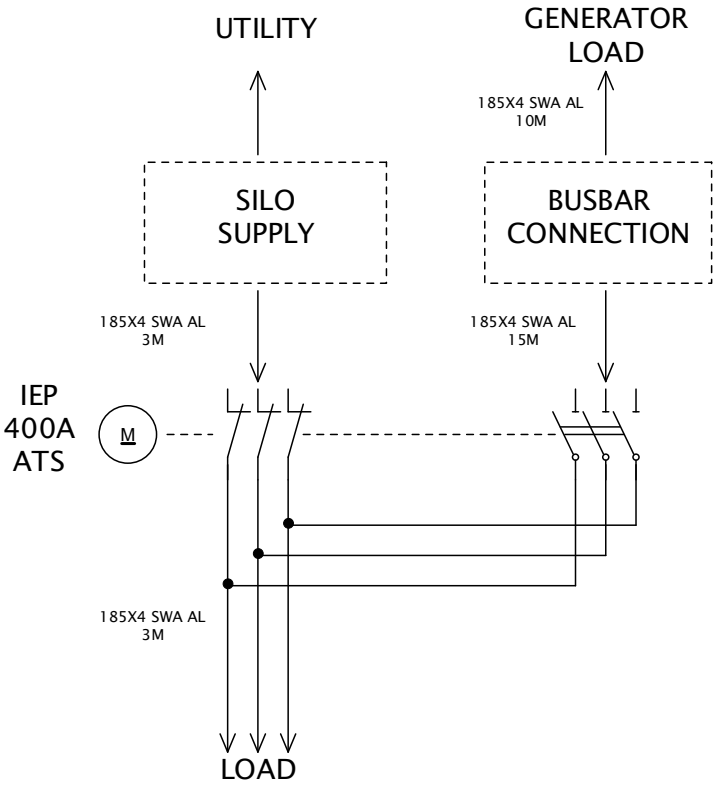
Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C18 MAIN AND CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **39/42**

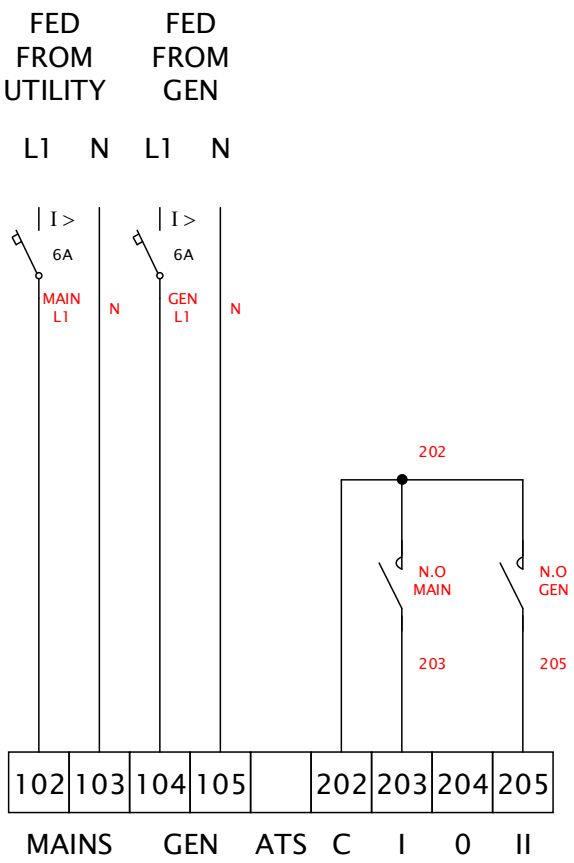


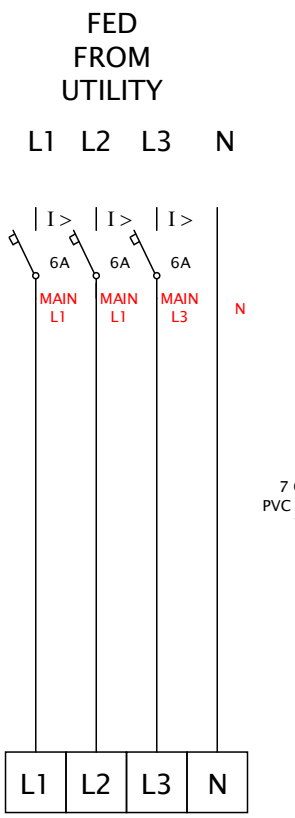
Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **C18 24V CONTROL** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **40/42**

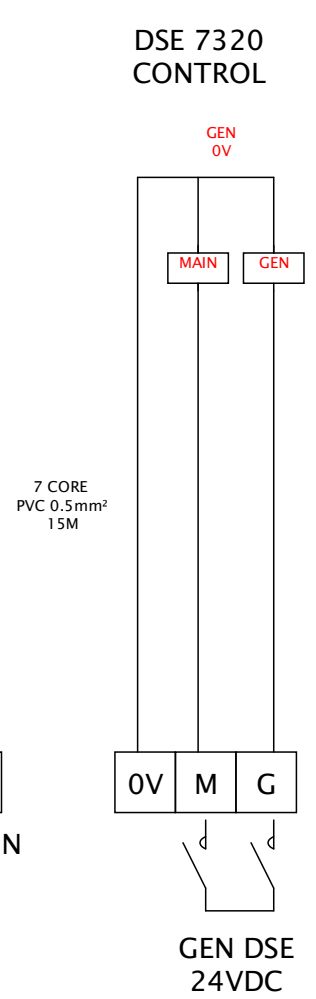


Responsible dep. **ENGINEERING**	Technical reference **TRANSFER SYSTEM**	Created **MARTIN ERASMUS**	Approved **PENDING**	
MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **ATS Layout** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. / Sheet **41/42**









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MIE ELECTRICAL MASTER INSTALLATION ELECTRICIAN	Contact details +2772994344	Document type **ELECTRICAL SCHEMATIC**	Document status **PENDING**	Rev. **001**
	Email adress info@mieelectrical.co.za Website www.mieelectrical.co.za	Title, supplementary title **ATS Control** **PIETERMARITZBURG**	Scale Date of issue **2025/08/06**	Lang. Sheet **42/42**

Cable Installation Checklist

Project: Remote I/O Panel Installation
Prepared by: Martin Erasmus
Date: 22/10/2025

General Cable Installation Tasks:

- Verify cable types and lengths match project specifications
- Inspect cable drums for damage before installation
- Use correct cable routes and containment systems
- Avoid sharp bends or tight pulling
- Label all cables at both ends
- Terminate cables as per panel and equipment requirements
- Test cable insulation resistance
- Perform continuity tests on all cores
- Record test results for each cable
- Earth all shielding and armouring as per design
- Ensure segregation between power and control cables
- Secure all cables neatly and safely with proper supports
- Complete as-built cable route drawings

Cable Schedule

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	BIN 11	RIO1-BIN11	PVC	12	0.5	25m	1.Positive
							2.Negative
							3.Bin 11A OI
							4.Bin 11A CI
							5.Bin 11A OQ
							6.Bin 11A CQ
							7.Bin 11B OI
							8.Bin 11B CI
							9.Bin 11B OQ
							10.Bin11B CQ
							11. SPARE
							12. SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	BIN 12	RIO1-BIN12	PVC	12	0.5	40m	1.Positive
							2.Negative
							3.Bin 12A OI
							4.Bin 12A CI
							5.Bin 12A OQ
							6.Bin 12A CQ
							7.Bin 12B OI
							8.Bin 12B CI
							9.Bin 12B OQ
							10.Bin12B CQ
							11. SPARE
							12. SPARE
RIO Panel 1	BIN 13	RIO1-BIN13	PVC	12	0.5	50m	1.Positive
							2.Negative
							3.Bin 13A OI
							4.Bin 13A CI
							5.Bin 13A OQ
							6.Bin 13A CQ
							7.Bin 13B OI
							8.Bin 13B CI
							9.Bin 13B OQ
							10.Bin13B CQ
							11. E-SILO CHOKE
							12. SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	BIN 14A	RIO1-BIN14A	PVC	12	0.5	20m	Digital Inputs/Outputs
							1.Positive
							2.Negative
							3.Bin 14A OI
							4.Bin 14A CI
							5.Bin 14A OQ
							6.Bin 14APK LI
							7.Bin14APK RI
							8.Bin14APKLQ
							9.Bin14APKRQ
							10.SPARE
							11.SPARE
							12.SPARE
RIO Panel 1	BIN 14B	RIO1-BIN14B	PVC	12	0.5	10m	Digital Inputs/Outputs
							1.Positive
							2.Negative
							3.Bin 14B OI
							4.Bin 14B CI
							5.Bin 14B OQ
							6.Bin 14BPK LI
							7. Bin14BPK RI
							8.Bin14BPKLQ
							9.Bin14BPKRQ
							10.SPARE
							11.SPARE
							12.SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	BIN 15A	RIO1-BIN15A	PVC	12	0.5	40m	1.Positive
							2.Negative
							3.Bin 15A OI
							4.Bin 15A CI
							5.Bin 15A OQ
							6.Bin 15APKLI
							7. Bin15APKRI
							8.Bin15APKLQ
							9.Bin15APKQ
							10.SPARE
							11.SPARE
							12.SPARE
RIO Panel 1	BIN 15B	RIO1-BIN15B	PVC	12	0.5	30m	1.Positive
							2.Negative
							3.Bin 15B OI
							4.Bin 15B CI
							5.Bin 15B OQ
							6.Bin 15BPK LI
							7.Bin15BPK RI
							8.Bin15BPKLQ
							9.Bin15BPKRQ
							10. SPARE
							11. SPARE
							12. SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	BIN 16A	RIO1-BIN16A	PVC	12	0.5	60m	1.Positive
							2.Negative
							3.Bin 16A OI
							4.Bin 16A CI
							5.Bin 16A OQ
							6.Bin16A PK LI
							7.Bin16A PKRI
							8.Bin16APKLQ
							9.Bin16APKRQ
							10. C17-RUN
							11. C12-RUN
							12. SPARE
RIO Panel 1	BIN 16B	RIO1-BIN16B	PVC	12	0.5	50m	1.Positive
							2.Negative
							3.Bin 16B OI
							4.Bin 16B CI
							5.Bin 16B OQ
							6.Bin16B PK LI
							7.Bin16B PKRI
							8.Bin16BPKLQ
							9.Bin16BPKRQ
							10. SPARE
							11. SPARE
							12. SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	V22/PS35	RIO1-V22/PS35	PVC	12	0.5	50m	1.Positive
							2.Negative
							3PS35-OI
							4.V22A-DI
							5.V22B-DI
							6.PS35-DQ
							7.V22A-DQ
							8.PS35-CI
							9.E10-RUN
							10.C11-RUN
							11.C13CHOKE
							12. SPARE
RIO Panel 1	C12 CHOKE	C12-CHOKE	PVC	2	0.5	10m	1.Positive
							2.C12 CHOKE
RIO Panel 1	C17-CHOKE	C17-CHOKE	PVC	2	0.5	10m	1.Positive
							2. C17 CHOKE
RIO Panel 1	C18-RUN	C18-RUN	PVC	2	0.5	10m	1.Positive
							2.C18-RUN
RIO Panel 1	C18-CHOKE	C18-CHOKE	PVC	2	0.5	25m	1.Positive
							2.C17-CHOKE
RIO Panel 1	C17-VSD	C17-CONTROL	PVC	12	0.5	4m	1.0V
							2.C17-STOP DQ
							3.C17-START DQ
							4.C17-RST DQ
							5.C17-ALARM
							6.24V

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 1	C18-VSD	C18-CONTROL	PVC	12	0.5	4m	1.0V
							2.C18-STOP DQ
							3.C18-START DQ
							4.C18-RST DQ
							5.C18-ALARM
							6.24V
MCC	C17-C18	C17-C18 SUPPLY	SWA	4	25	75m	L1-L2-L3-N-BARE EARTH
C17 SUPPLY	C17 MTR	C17 LOAD	SWA	4	4	10m	L1-L2-L3-E
C18 SUPPLY	C18 MTR	C18 LOAD	SWA	4	6	10m	L1-L2-L3-E
RIO Panel 2	C12-C13	C12-C13-CONTROL	PVC	12	0.5	20m	1.0V
							2. C12-START/STOP DQ
							3.C12-START/STOP DQ
							4. SPARE
							5.SPARE
							6.SPARE
							7.SPARE
							8.SPARE
							9.SPARE
							10.SPARE
							11.SPARE
							12.SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 2	RIO2-SUPPLY	RIO2-SUPLY	PVC	12	0.5	20m	1.L
							2. N
							3.SPARE
							4. SPARE
RIO Panel 3	SCALE CONTROL	SCALE CONTROL DI	PVC	12	0.5	5m	1.SCALE 24VDC
							2. HOLD
							3.RESET
							4. SPARE
							5.SPARE
							6. SPARE
							7. SPARE
							8. SPARE
							9. SPARE
							10. SPARE
							11. SPARE
							12.SPARE
RIO Panel 3	SCALE CONTROL	SCALE CONTROL DQ	PVC	12	0.5	5m	1.RIO 3 24VDC
							2. ALARM
							3.RUN
							4. SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 3	C16-C19	C16-C19	PVC	12	0.5	10m	1.24V
							2.0V
							3.E10-START COMMAND
							4.C10 START COMMAND
							5. E10 START/STOP
							6.C10 START/STOP
							7. C14 START/STOP
							8.C15-START/STOP
							19.SPARE
							10.SPARE
							11.SPARE
							12.SPARE
RIO Panel 3	LEVELS	LEVELS	PVC	12	0.5	30m	1.24V
							2.HIGH LEVEL
							3.LOW LEVEL
							4.SPARE
							5.SPARE
							6.SPARE
							7.SPARE
							8.SPARE
							9.SPARE
							10.SPARE
							11.SPARE
							12.SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 3	LEVELS SUPPLY	LEVELS SUPPLY	PVC	4	0.5	30m	1.LIVE
							2.NEUTRAL
							3.SPARE
							4. EARTH
RIO Panel 3	SCALE HIGH LEVEL	SCALE HIGH LEVEL	PVC	4	0.5	20m	1.LIVE
							2.NEUTRAL
							3.SPARE
							4. EARTH
RIO Panel 3	SCALE HIGH LEVEL	SCALE HIGH LEVEL	PVC	4	0.5	20m	1.24VDC
							2.HIGH LEVEL DI
							3.SPARE
							4. EARTH
RIO Panel 3	PRODUCT FLOW	PRODUCT FLOW SUPPLY	PVC	4	0.5	20m	1.LIVE
							2.NEUTRAL
							3.SPARE
							4. EARTH
RIO Panel 3	PRODUCT FLOW	PRODUCT FLOW	PVC	4	0.5	20m	1.24VDC
							2.PRODUCT FLOW DI
							3.SPARE
							4. EARTH
RIO Panel 3	E10 CHOKE	E10-CHOKE	PVC	4	0.5	25m	1.LIVE
							2. 230V RELAY COIL

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
RIO Panel 4	PS1	RIO4-BIN1/BIN6	PVC	12	0.5	70	1.Positive
							2.Negative
							3.PS1 OI
							4.PS1 CI
							5.PS1 OQ
							6.PS1 CQ
							7.Bin 1 DI
							8.Bin 6 DI
							9.Bin 1 DQ
							10.Bin 6 DQ
							11.C4 RUN
							12. SPARE
RIO Panel 4	PS2	RIO4-BIN2-BIN7	PVC	12	0.5	60	1.Positive
							2.Negative
							3.PS2 OI
							4.PS2 CI
							5.PS2 OQ
							6.PS2 CQ
							7.Bin 2DI
							8.Bin 7DI
							9.Bin 2DQ
							10.Bin 7DQ
							11. SPARE
							12. SPARE
RIO Panel 4	PS3	RIO4-BIN3/BIN8	PVC	12	0.5	50	1.Positive
							2.Negative
							3.PS3 OI
							4.PS3 CI
							5.PS3 ODQ
							6.PS3 CDQ
							7.Bin 3DI
							8.Bin 8DI
							9.Bin 3DQ
							10.Bin 8DQ

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
							11. SPARE
							12. SPARE
RIO Panel 4	PS4	RIO4-BIN4-BIN9	PVC	12	0.5	40	1.Positive
							2.Negative
							3.PS4 ODI
							4.PS4 CDI
							5.PS4 ODQ
							6.PS4 CDQ
							7.Bin 4DI
							8.Bin 9DI
							9.Bin 4DQ
							10.Bin 9DQ
							11. SPARE
							12. SPARE
RIO Panel 4	PS5	RIO4-BIN5-BIN10	PVC	12	0.5	20	1.Positive
							2.Negative
							3.PS5 ODI
							4.PS5 CDI
							5.PS5 ODQ
							6.PS5 CDQ
							7.Bin 5DI
							8.Bin 10DI
							9.Bin 5DQ
							10.Bin 10DQ
							11. C4 CHOKE
							12. SPARE
RIO Panel 4	PS7	RIO4-PS7	PVC	12	0.5	20	1.Positive
							2.Negative
							3.PS7 ODI
							4.PS7 CDI
							5.PS7 ODQ
							6.C5-RUN
							7.SPARE

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
							8.SPARE
							9.SPARE
							10.SPARE
							11. SPARE
							12. SPARE
RIO Panel 4	PS7	RIO4-PS8-PS9	PVC	12	0.5	25	1.Positive
							2.Negative
							3.PS8 ODI
							4.PS8 CDI
							5.PS8 ODQ
							6.PS9 ODI
							7.PS9 CDI
							8.PS9 ODQ
							9.C10-RUN
							10.SPARE
							11. SPARE
							12. SPARE
RIO Panel 4	C4-VSD	C18-CONTROL	PVC	12	0.5	4m	1.0V
							2.C4-STOP DQ
							3.C4-START DQ
							4.C4-RST DQ
							5.C4-ALARM
							6.24V
MCC SCALE	C4-VSD	C4 - SUPPLY	SWA	4	6	50m	L1-L2-L3-N-BARE EARTH
C4 VSD	C4 MOTOR	C4 LOAD	SWA	4	6	25m	L1-L2-L3-E
C4 VSD	RIO 4	RIO4-SUPPLY	PVC	4	0.5	4M	L , N, EARTH

From Equipment Panel	To Equipment /Panel	Cable Identification	Cable Type	No. of Cores	Core Size mm²	Distance (m)	Function Description
MCC	RIO 4	MCC-RIO4	ALUM	UTP		50	NETWORK
RIO4	RIO 3	RIO 4-RIO3	ALUM	UTP		40	NETWORK
RIO3	RIO 2	RIO 3-RIO2	ALUM	UTP		40	NETWORK
RIO2	CONTROL ROOM	ANIMAL FEEDS	ALUM	UTP		25	NETWORK
RIO2	RIO 1	RIO 2-RIO1	ALUM	UTP		70	NETWORK

Client	Afgri Grain Management
Project	Pietermaritzburg transfer
Description	IO List
Contractor	MIE Electrical/Corrotech Systems
Date	22/10/2025

PLC

Module 1	Slot 1
Input	Description
DI 0	C11 Running to Mill
DI 1	== SPARE ==
DI 2	== SPARE ==
DI 3	== SPARE ==
DI 4	== SPARE ==
DI 5	== SPARE ==
DI 6	== SPARE ==
DI 7	== SPARE ==
DI 8	== SPARE ==
DI 9	== SPARE ==
DI 10	V13 Diverting to V14
DI 11	V13 Diverting to C14
DI 12	V2 Diverting to Bin 1
DI 13	V2 Diverting to Bin 6
DI 14	V3 Diverting to Bin 2
DI 15	V3 Diverting to Bin 7

Module 1	Slot 2
Input	Description
DI 0	V4 Diverting to Bin 3
DI 1	V4 Diverting to Bin 8
DI 2	V5 Diverting to Bin 4
DI 3	V5 Diverting to Bin 9
DI 4	V6 Diverting to Bin 5
DI 5	V6 Diverting to Bin 10
DI 6	V9 Diverting to V10
DI 7	V9 Diverting to C2
DI 8	V10 Diverting to E5
DI 9	V10 Diverting to E8
DI 10	V8 Diverting to E1
DI 11	V8 Diverting to E3
DI 12	V12 Diverting to E3
DI 13	V12 Diverting to E9
DI 14	V11 Diverting to V12
DI 15	V11 Diverting to E1

Module	Slot
1	3
Input	Description
DI 0	SM2 Rotary seal - Healthy
DI 1	SM2 Rotary seal - Running
DI 2	SM1 Rotary seal - Healthy
DI 3	SM1 Rotary seal - Running
DI 4	SM2 Vibrator - Healthy
DI 5	SM2 Vibrator - Running
DI 6	SM2 Fan 1 - Healthy
DI 7	SM2 Fan 1 - Running
DI 8	SM2 Fan 2 - Healthy
DI 9	SM2 Fan 2 - Running
DI 10	== SPARE ==
DI 11	== SPARE ==
DI 12	SM1 Vibrator - Healthy
DI 13	SM1 Vibrator - Running
DI 14	SM1 Fan 1 - Healthy
DI 15	SM1 Fan 1 - Running

Module	Slot
1	4
Input	Description
DI 0	SM1 Fan 2 - Healthy
DI 1	SM1 Fan 2 - Running
DI 2	SK1 - Healthy
DI 3	SK1 - Running
DI 4	SK2 - Healthy
DI 5	SK2 - Running
DI 6	E6 - Healthy
DI 7	E6 - Running
DI 8	E7 - Healthy
DI 9	E7 - Running
DI 10	E9 - Healthy
DI 11	E9 - Running
DI 12	E8 - Healthy
DI 13	E8 - Running
DI 14	SK3 - Healthy
DI 15	SK3 - Running

Module 2	Slot 1
Input	Description
DI 0	C1 - Healthy
DI 1	C1 - Running
DI 2	C2 - Healthy
DI 3	C2 - Running
DI 4	C3 - Healthy
DI 5	C3 - Running
DI 6	== SPARE ==
DI 7	== SPARE ==
DI 8	C5 - Healthy
DI 9	C5 - Running
DI 10	C6 - Healthy
DI 11	C6 - Running
DI 12	C7 - Healthy
DI 13	C7 - Running
DI 14	C8 - Healthy
DI 15	C8 - Running
Module 2	Slot 2
Input	Description
DI 0	C9 - Healthy
DI 1	C9 - Running
DI 2	SM1 - Low Level
DI 3	SM2 - Low Level
DI 4	SM2 - Choke sensor
DI 5	SM1 - Choke sensor
DI 6	B1 - Healthy
DI 7	B1 - Running
DI 8	B2 - Healthy
DI 9	B2 - Running
DI 10	C11 - Healthy
DI 11	C11 - Running to Silo
DI 12	ESILO - Healthy
DI 13	ESILO - Running
DI 14	== SPARE ==
DI 15	== SPARE ==

Module 2	Slot 3
Input	Description
DI 0	SM1 Fan 3 - Healthy
DI 1	SM1 Fan 3 - Running
DI 2	SM2 Fan 3 - Healthy
DI 3	SM2 Fan 3 - Running
DI 4	E1 - Healthy
DI 5	E1 - Running
DI 6	E2 - Healthy
DI 7	E2 - Running
DI 8	E3 - Healthy
DI 9	E3 - Running
DI 10	E5 - Healthy
DI 11	E5 - Running
DI 12	S1 - Healthy
DI 13	S1 - Running
DI 14	RS1 - Healthy
DI 15	RS1 - Running
Module 2	Slot 4
Input	Description
DI 0	S2 - Healthy
DI 1	S2 - Running
DI 2	RS2 - Healthy
DI 3	RS2 - Running
DI 4	SM2 - High level
DI 5	SM1 - High level
DI 6	E6 - Slip
DI 7	E7 - Slip
DI 8	E8 - Slip
DI 9	E9 - Slip
DI 10	V1 - Diverting to C4
DI 11	V1 - Diverting to C14
DI 12	== SPARE ==
DI 13	== SPARE ==
DI 14	== SPARE ==
DI 15	== SPARE ==

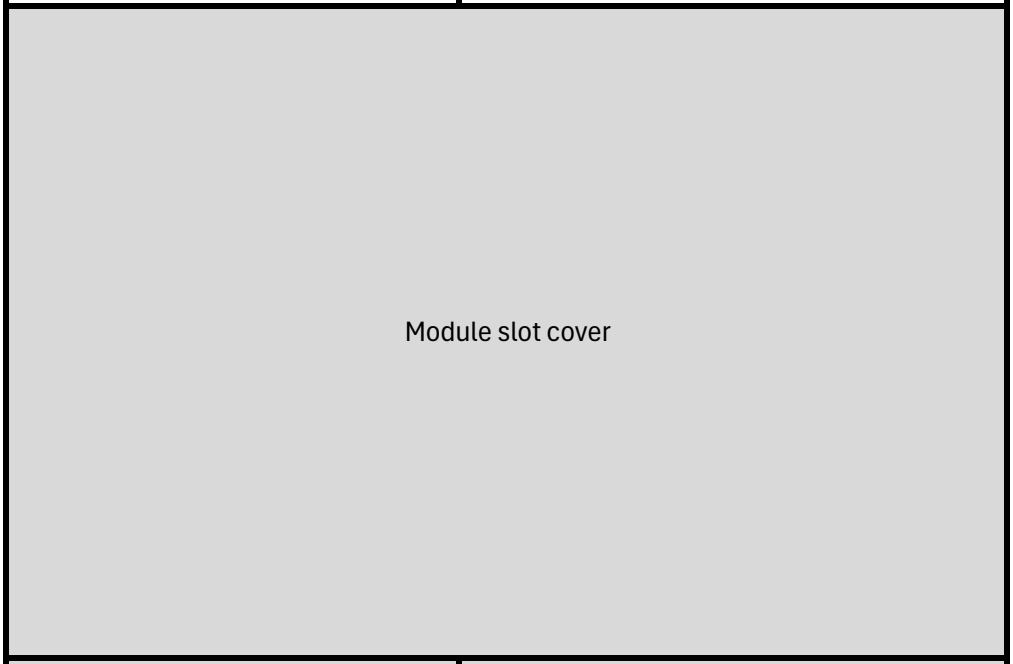
Module	Slot
3	1
Output	**Description**
DQ 0	C1 - Motor start
DQ 1	C2 - Motor start
DQ 2	C3 - Motor start
DQ 3	C4 - Motor start
DQ 4	C5 - Motor start
DQ 5	C6 - Motor start
DQ 6	C7 - Motor start
DQ 7	C8 - Motor start
DQ 8	C9 - Motor start
DQ 9	C11 - Motor start to Silo
DQ 10	ESILO - Motor start
DQ 11	B1 - Motor start
DQ 12	B2 - Motor start
DQ 13	== SPARE ==
DQ 14	== SPARE ==
DQ 15	== SPARE ==
Module	Slot
3	2
Output	**Description**
DQ 0	SM1 Fan 3 - Motor start
DQ 1	SM2 Fan 3 - Motor start
DQ 2	E1 - Motor start
DQ 3	== SPARE ==
DQ 4	E3 - Motor start
DQ 5	E5 - Motor start
DQ 6	S1 - Motor start
DQ 7	RS1 - Motor start
DQ 8	S2 - Motor start
DQ 9	RS2 - Motor start
DQ 10	S2 - Motor switch
DQ 11	C11 - Motor start to Mill
DQ 12	== SPARE ==
DQ 13	== SPARE ==
DQ 14	== SPARE ==
DQ 15	Startup alarm

Module	Slot
3	3
Output	Description
DQ 0	SM2 Rotary seal - Motor start
DQ 1	SM1 Rotary seal - Motor start
DQ 2	SM2 Vibrator - Motor start
DQ 3	SM2 Fan1 - Motor start
DQ 4	SM2 Fan2 - Motor start
DQ 5	== SPARE ==
DQ 6	SM1 Vibrator - Motor start
DQ 7	SM1 Fan1 - Motor start
DQ 8	SM1 Fan2 - Motor start
DQ 9	SK1 - Motor start
DQ 10	SK2 - Motor start
DQ 11	E6 - Motor start
DQ 12	E7 - Motor start
DQ 13	E9 - Motor start
DQ 14	E8 - Motor start
DQ 15	SK3 - Motor start
Module	Slot
3	4

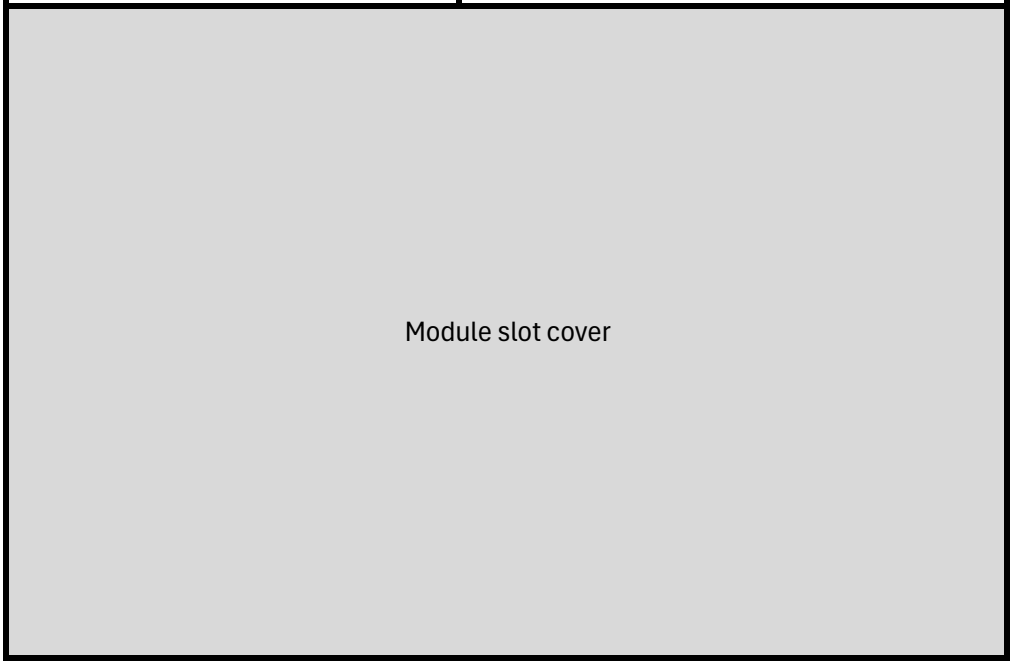
RS485

Module	Slot
4	1
Input	**Description**
DI 0	== SPARE ==
DI 1	== SPARE ==
DI 2	== SPARE ==
DI 3	== SPARE ==
DI 4	== SPARE ==
DI 5	== SPARE ==
DI 6	== SPARE ==
DI 7	== SPARE ==
DI 8	== SPARE ==
DI 9	== SPARE ==
DI 10	== SPARE ==
DI 11	== SPARE ==
DI 12	== SPARE ==
DI 13	== SPARE ==
DI 14	== SPARE ==
DI 15	== SPARE ==
Module	Slot
4	2
Output	**Description**
DQ 0	== SPARE ==
DQ 1	== SPARE ==
DQ 2	== SPARE ==
DQ 3	== SPARE ==
DQ 4	== SPARE ==
DQ 5	== SPARE ==
DQ 6	== SPARE ==
DQ 7	== SPARE ==
DQ 8	== SPARE ==
DQ 9	== SPARE ==
DQ 10	== SPARE ==
DQ 11	== SPARE ==
DQ 12	== SPARE ==
DQ 13	== SPARE ==
DQ 14	== SPARE ==
DQ 15	== SPARE ==

Module 4	Slot 3



Module 4	Slot 4



Module 5	
Input	Description
AI0	Elevator E1 current
AI1	Elevator ESILO current
AI2	Elevator E3 current
AI3	Elevator E5 current
AI4	Elevator E6 current
AI5	Elevator E7 current
AI6	Elevator E9 current
AI7	Elevator E8 current

RIO 1

Module	Slot
1	1
Input	**Description**
DI 0	PS28 Opened
DI 1	PS28 Closed
DI 2	PS29 Opened
DI 3	PS29 Closed
DI 4	PS26 Opened
DI 5	PS26 Closed
DI 6	PS27 Opened
DI 7	PS27 Closed
DI 8	PS25 Opened
DI 9	PS25 Closed
DI 10	PS24 Opened
DI 11	PS24 Closed
DI 12	PS35 Opened
DI 13	PS35 Closed
DI 14	PS34 Opened
DI 15	PS34 Closed
Module	Slot
1	2
Input	**Description**
DI 0	PS33 Opened
DI 1	PS33 Closed
DI 2	PS32 Opened
DI 3	PS32 Closed
DI 4	PS31 Opened
DI 5	PS31 Closed
DI 6	PS30 Opened
DI 7	PS30 Closed
DI 8	V21 Diverting to C17
DI 9	V21 Diverting to C12
DI 10	V20 Diverting to C12
DI 11	V20 Diverting to C17
DI 12	V19 Diverting to C12
DI 13	V19 Diverting to C17
DI 14	V18 Diverting to C12
DI 15	V18 Diverting to C17

Module	Slot
1	3
Input	**Description**
DI 0	V17 Diverting to C12
DI 1	V17 Diverting to C17
DI 2	V16 Diverting to C12
DI 3	V16 Diverting to C17
DI 4	E-Silo choke
DI 5	C17 Choke
DI 6	C17 Rotary Sensor
DI 7	C18 Choke
DI 8	C18 Rotary Sensor
DI 9	PS36 - Opened
DI 10	V22 Diverting to C11
DI 11	V22 Diverting to E10
DI 12	C17 Running
DI 13	C18 Running
DI 14	E10 - Slip
DI 15	C11 - Rotary Sensor
Module	Slot
1	4
Input	**Description**
DI 0	C12 - Rotary Sensor
DI 1	C12 - Choke
DI 2	C13 - Rotary Sensor
DI 3	C13 - Choke
DI 4	PS36 - Closed
DI 5	ESILO - Slip
DI 6	C17 - VSD Fault
DI 7	C18 - VSD Fault
DI 8	== SPARE ==
DI 9	== SPARE ==
DI 10	== SPARE ==
DI 11	== SPARE ==
DI 12	== SPARE ==
DI 13	== SPARE ==
DI 14	== SPARE ==
DI 15	== SPARE ==

Module 1	Slot 5
Output	Description
DQ 0	PS28 Open
DQ 1	PS29 Open
DQ 2	PS26 Open
DQ 3	PS27 Open
DQ 4	PS25 Open
DQ 5	PS24 Open
DQ 6	PS35 Open
DQ 7	PS34 Open
DQ 8	V21 Divert to C12
DQ 9	== SPARE ==
DQ 10	V20 Divert to C12
DQ 11	== SPARE ==
DQ 12	PS33 Open
DQ 13	PS32 Open
DQ 14	V19 Divert to C12
DQ 15	== SPARE ==
Module 1	Slot 6
Output	Description
DQ 0	V18 Divert to C12
DQ 1	== SPARE ==
DQ 2	PS31 Open
DQ 3	PS30 Open
DQ 4	V17 Divert to C12
DQ 5	== SPARE ==
DQ 6	V16 Divert to C12
DQ 7	== SPARE ==
DQ 8	PS36 Open
DQ 9	C17 start
DQ 10	C17 stop
DQ 11	C18 start
DQ 12	C18 stop
DQ 13	V22 Divert to E10
DQ 14	C17 VSD Reset
DQ 15	C18 VSD Reset

RIO 2

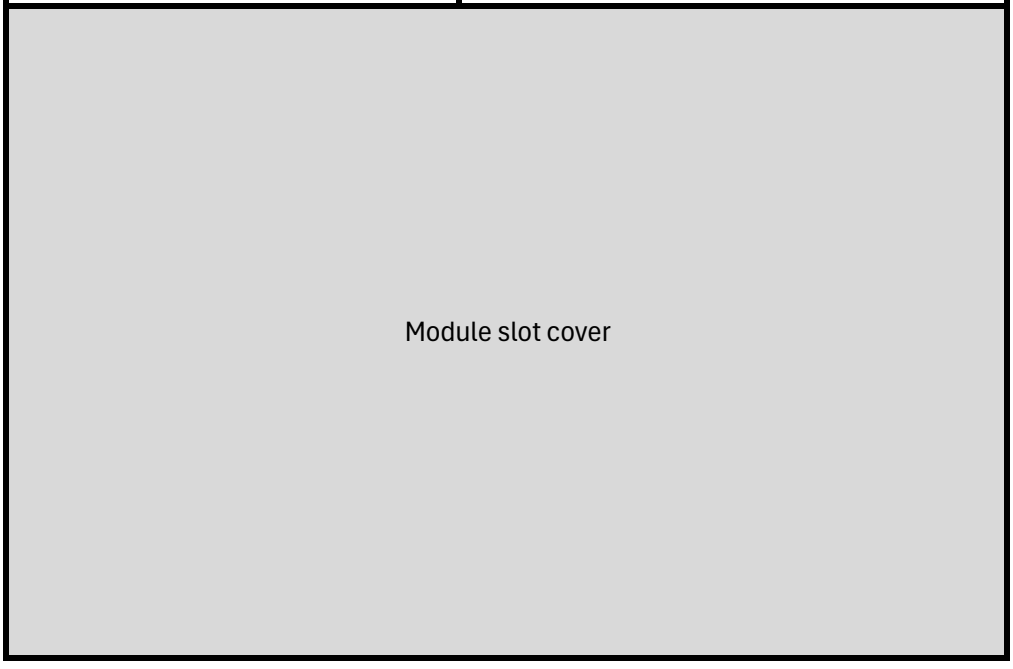
Module	Slot
1	1

Input	Description
DI 0	C12 - Healthy
DI 1	C12 - Running
DI 2	C13 - Healthy
DI 3	C13 - Running
DI 4	== SPARE ==
DI 5	== SPARE ==
DI 6	== SPARE ==
DI 7	== SPARE ==
DI 8	== SPARE ==
DI 9	== SPARE ==
DI 10	== SPARE ==
DI 11	== SPARE ==
DI 12	== SPARE ==
DI 13	== SPARE ==
DI 14	== SPARE ==
DI 15	== SPARE ==

Module	Slot
1	2

Module slot cover

Module	Slot
1	3
Output	Description
DQ 0	C12 Start/stop
DQ 1	C13 Start/stop
DQ 2	== SPARE ==
DQ 3	== SPARE ==
DQ 4	== SPARE ==
DQ 5	== SPARE ==
DQ 6	== SPARE ==
DQ 7	== SPARE ==
DQ 8	== SPARE ==
DQ 9	== SPARE ==
DQ 10	== SPARE ==
DQ 11	== SPARE ==
DQ 12	== SPARE ==
DQ 13	== SPARE ==
DQ 14	== SPARE ==
DQ 15	== SPARE ==
Module	Slot
1	4



RIO 3

Module	Slot
1	1

Input	Description
DI 0	E10 - Healthy
DI 1	C10 - Healthy
DI 2	Hopper low level
DI 3	Hopper high level
DI 4	Scale OK
DI 5	E10 choke
DI 6	Product Flow
DI 7	Scale High Level
DI 8	E10 - Running
DI 9	C10 - Running
DI 10	C14 - Running
DI 11	C15 - Running
DI 12	== SPARE ==
DI 13	== SPARE ==
DI 14	== SPARE ==
DI 15	== SPARE ==

Module	Slot
1	2

Module slot cover

Module	Slot
1	3

Output	Description
DQ 0	== SPARE ==
DQ 1	Scale Run
DQ 2	== SPARE ==
DQ 3	E10 Start/stop
DQ 4	C10 Start/stop
DQ 5	C14 Start/stop
DQ 6	C15 Start/stop
DQ 7	== SPARE ==
DQ 8	== SPARE ==
DQ 9	== SPARE ==
DQ 10	== SPARE ==
DQ 11	== SPARE ==
DQ 12	== SPARE ==
DQ 13	== SPARE ==
DQ 14	== SPARE ==
DQ 15	== SPARE ==

Module	Slot
1	4

Module slot cover

RIO 4

Module	Slot
1	1
Input	**Description**
DI 0	PS1 opened
DI 1	PS1 closed
DI 2	PS2 opened
DI 3	PS2 closed
DI 4	PS3 opened
DI 5	PS3 closed
DI 6	PS4 opened
DI 7	PS4 closed
DI 8	PS5 opened
DI 9	PS5 closed
DI 10	V2 - Diverting to Bin 1
DI 11	V3 - Diverting to Bin 2
DI 12	V4 - Diverting to Bin 3
DI 13	V5 - Diverting to Bin 4
DI 14	V6 - Diverting to Bin 5
DI 15	V2 - Diverting to Bin 6
Module	Slot
1	2
Input	**Description**
DI 0	V3 - Diverting to Bin 7
DI 1	V4 - Diverting to Bin 8
DI 2	V5 - Diverting to Bin 9
DI 3	V6 - Diverting to Bin 10
DI 4	PS8 Opened
DI 5	PS8 Closed
DI 6	PS9 Opened
DI 7	PS9 Closed
DI 8	C4 - Rotary Sensor
DI 9	C4 - Running
DI 10	PS7 opened
DI 11	PS7 closed
DI 12	C5 - Rotary Sensor
DI 13	C10 - Rotary Sensor
DI 14	C4 - Choke
DI 15	C4 - VSD Alarm

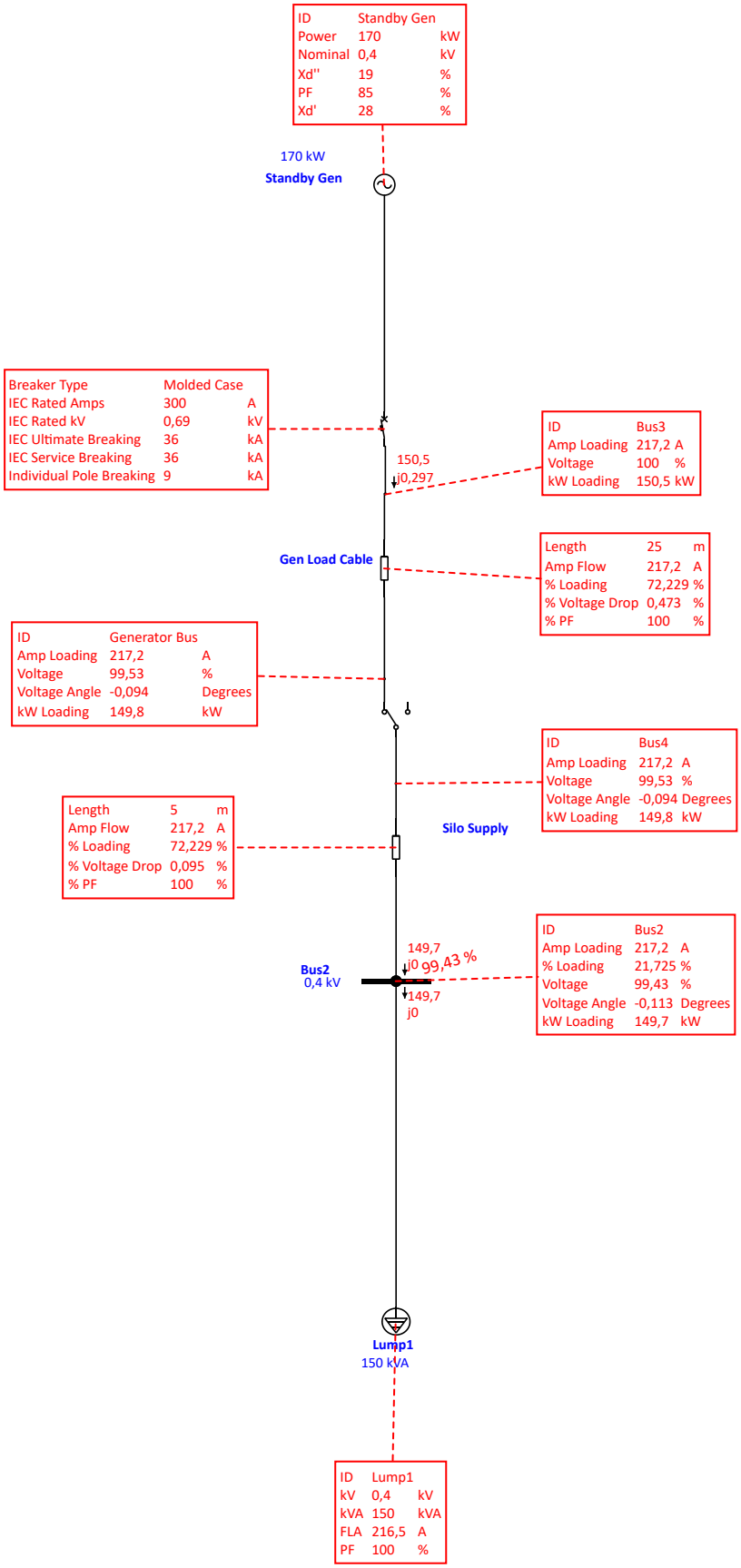
Module 1	Slot 3
Output	Description
DQ 0	PS1 - Open
DQ 1	== SPARE ==
DQ 2	PS2 - Open
DQ 3	== SPARE ==
DQ 4	PS3 - Open
DQ 5	== SPARE ==
DQ 6	PS4 - Open
DQ 7	== SPARE ==
DQ 8	PS5 - Open
DQ 9	== SPARE ==
DQ 10	V2 - Divert to Bin 1
DQ 11	V3 - Divert to Bin 2
DQ 12	== SPARE ==
DQ 13	== SPARE ==
DQ 14	V6 - Divert to Bin 5
DQ 15	== SPARE ==
Module 1	Slot 4
Output	Description
DQ 0	== SPARE ==
DQ 1	V4 - Divert to Bin 3
DQ 2	V5 - Divert to Bin 9
DQ 3	== SPARE ==
DQ 4	PS8 Open
DQ 5	PS9 Open
DQ 6	C4 stop
DQ 7	C4 Start
DQ 8	VSD Reset
DQ 9	PS7 open
DQ 10	== SPARE ==
DQ 11	== SPARE ==
DQ 12	== SPARE ==
DQ 13	== SPARE ==
DQ 14	== SPARE ==
DQ 15	== SPARE ==

ANNEXURE D

Test results, Studies and Calculations

ANNEXURE D-1

Etap Loadflow and Report


ID Standby Gen
Power 170 kW
Nominal 0,4 kV
Xd'' 19 %
PF 85 %
Xd' 28 %
170 kW
Standby Gen
Breaker Type Molded Case
IEC Rated Amps 300 A
IEC Rated kV 0,69 kV
IEC Ultimate Breaking 36 kA
IEC Service Breaking 36 kA
Individual Pole Breaking 9 kA
150,5
j0,297
ID Bus3
Amp Loading 217,2 A
Voltage 100 %
kW Loading 150,5 kW
Gen Load Cable
Length 25 m
Amp Flow 217,2 A
% Loading 72,229 %
% Voltage Drop 0,473 %
% PF 100 %
ID Generator Bus
Amp Loading 217,2 A
Voltage 99,53 %
Voltage Angle -0,094 Degrees
kW Loading 149,8 kW
ID Bus4
Amp Loading 217,2 A
Voltage 99,53 %
Voltage Angle -0,094 Degrees
kW Loading 149,8 kW
Length 5 m
Amp Flow 217,2 A
% Loading 72,229 %
% Voltage Drop 0,095 %
% PF 100 %
Silo Supply
149,7
j0
99,43 %
Bus2
0,4 kV
149,7
j0
ID Bus2
Amp Loading 217,2 A
% Loading 21,725 %
Voltage 99,43 %
Voltage Angle -0,113 Degrees
kW Loading 149,7 kW
Lump1
150 kVA
ID Lump1
kV 0,4 kV
kVA 150 kVA
FLA 216,5 A
PF 100 %

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (1): Design

Generation Category (1): Design

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	0	3	4

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	0	0	0	2	0	1	3

Method of Solution:	Adaptive Newton-Raphson Method
Maximum No. of Iteration:	99
Precision of Solution:	0.0001000
System Frequency:	50.00 Hz
Unit System:	Metric
Project Filename:	Pietermaritzburg Transfer
Output Filename:	C:\ETAP 2400\Pietermaritzburg Transfer\Generator.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Individual	
Cable / Busway Resistance:	Yes	Individual	

Bus Input Data

Bus			Initial Voltage		Load							
					Constant kVA		Constant Z		Constant I		Generic	
ID	kV	Sub-sys	% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar
Bus2	0.400	1	100.0	0.0	0.120	0.000	0.030	0.000				
Bus3	0.400	1	100.0	0.0								
Bus4	0.400	1	100.0	0.0								
Generator Bus	0.400	1	100.0	0.0								
Total Number of Buses: 4					0.120	0.000	0.030	0.000	0.000	0.000	0.000	0.000

Generation Bus				Voltage		Generation			Mvar Limits	
ID	kV	Type	Sub-sys	% Mag.	Angle	MW	Mvar	% PF	Max	Min
Bus3	0.400	Swing	1	100.0	0.0					
						0.000	0.000			

Line/Cable/Busway Input Data

ohms or siemens/1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway ID	Library	Size	Length Adj. (m)	Length % Tol.	#/Phase	T (°C)	R	X	Y
Gen Load Cable	1,0NALN4	185	25.0	0.0	1	75	0.201050	0.070000	0.0000880
Silo Supply	1,0NALN4	185	5.0	0.0	1	75	0.201050	0.070000	0.0000880

Line / Cable / Busway resistances are listed at the specified temperatures.

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
Gen Load Cable	Cable	Bus3	Generator Bus	314.14	109.38	332.64	0.0000004
Silo Supply	Cable	Bus4	Bus2	62.83	21.88	66.53	0.0000001
400A ATS	Tie Switch	Bus4	Generator Bus				

LOAD_FLOW_REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Bus2	0.400	99.432	-0.1	0.000	0.000	0.150	0.000	Bus4	-0.150	0.000	217.2	100.0	
*Bus3	0.400	100.000	0.0	0.151	0.000	0.000	0.000	Generator Bus	0.151	0.000	217.2	100.0	
Bus4	0.400	99.527	-0.1	0.000	0.000	0.000	0.000	Bus2	0.150	0.000	217.2	100.0	
								Generator Bus	-0.150	0.000	217.2	100.0	
Generator Bus	0.400	99.527	-0.1	0.000	0.000	0.000	0.000	Bus3	-0.150	0.000	217.2	100.0	
								Bus4	0.150	0.000	217.2	100.0	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

\# Indicates a bus with a load mismatch of more than 0.1 MVA

Bus Loading Summary Report

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
Bus2	0.400	1000.0	0.120		0.030						0.150	100.0	217.2	21.7
Bus3	0.400										0.151	100.0	217.2	
Bus4	0.400										0.150	100.0	217.2	
Generator Bus	0.400										0.150	100.0	217.2	

* Indicates operating load of a bus exceeds the bus critical limit (100.0% of the Continuous Ampere rating).
\# Indicates operating load of a bus exceeds the bus marginal limit (95.0% of the Continuous Ampere rating).

Branch Loading Summary Report

CKT / Branch		Busway / Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
Gen Load Cable	Cable	300.78	217.25	72.23					
Silo Supply	Cable	300.78	217.25	72.23					

* Indicates a branch with operating load exceeding the branch capability.

Branch Losses Summary Report

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	MW	Mvar	MW	Mvar	kW	kvar	From	To	
Gen Load Cable	0.151	0.000	-0.150	0.000	0.7	0.2	100.0	99.5	0.47
Silo Supply	-0.150	0.000	0.150	0.000	0.1	0.0	99.4	99.5	0.09
					0.9	0.3			

* This Transmission Line includes Series Capacitor.

Alert Summary Report

	% Alert Settings	
	Critical	**Marginal**
Loading		
Bus	100.0	95.0
Cable / Busway	100.0	95.0
Reactor	100.0	95.0
Line	100.0	95.0
Transformer	100.0	95.0
Panel	100.0	95.0
Protective Device	100.0	95.0
Generator	100.0	95.0
Inverter/Charger	100.0	95.0
Bus Voltage		
OverVoltage	105.0	102.0
UnderVoltage	95.0	98.0
Generator Excitation		
OverExcited (Q Max.)	100.0	95.0
UnderExcited (Q Min.)	100.0	

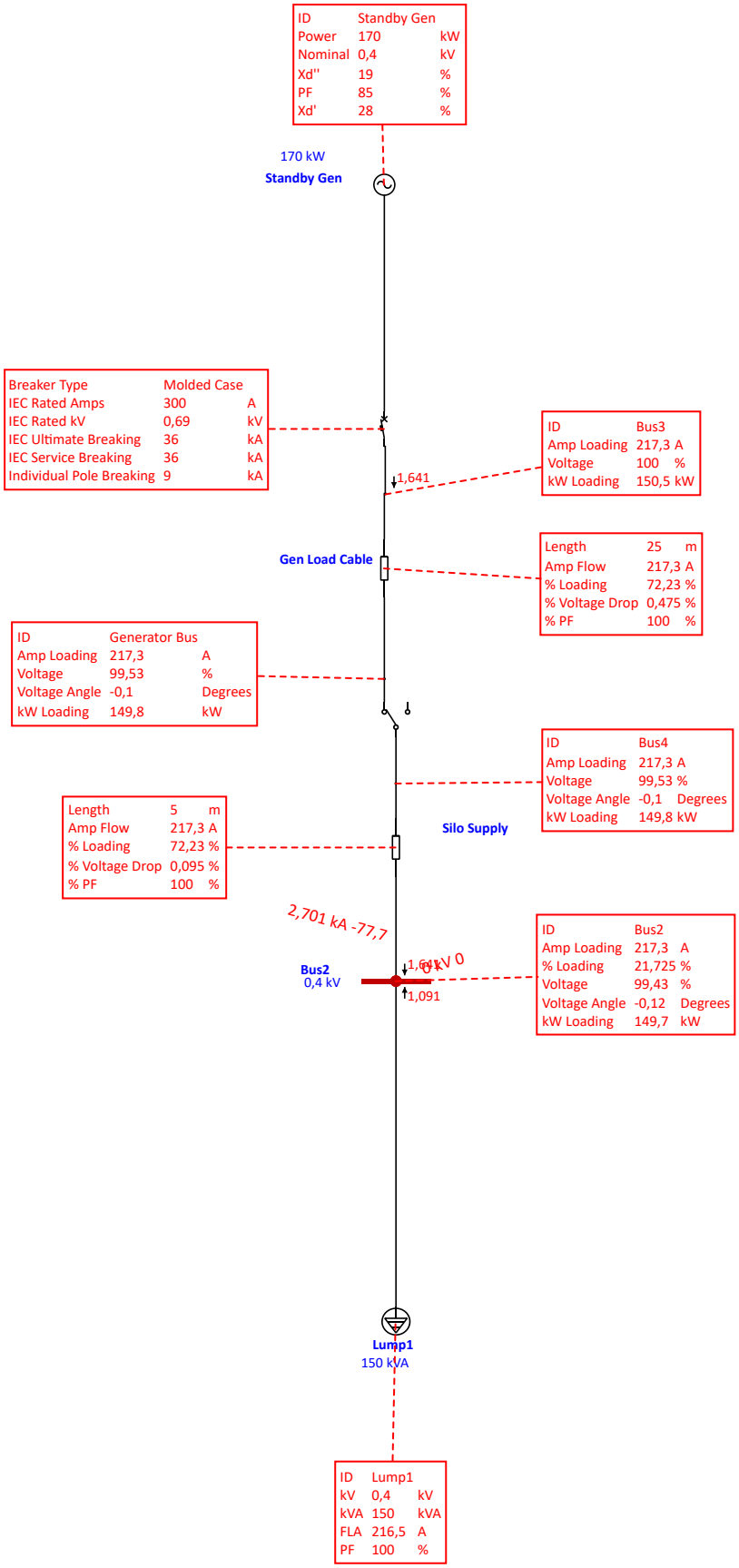
SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	0.151	0.000	0.151	100.00 Lagging
Source (Non-Swing Buses):	0.000	0.000	0.000	
Total Demand:	0.151	0.000	0.151	100.00 Lagging
Total Motor Load:	0.120	0.000	0.120	100.00 Lagging
Total Static Load:	0.030	0.000	0.030	100.00 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.001	0.000		
System Mismatch:	0.000	0.000		

Number of Iterations: 2

ANNEXURE D-2

Etap PSCC and Report


ID Standby Gen
Power 170 kW
Nominal 0,4 kV
Xd'' 19 %
PF 85 %
Xd' 28 %
170 kW
Standby Gen
Breaker Type Molded Case
IEC Rated Amps 300 A
IEC Rated kV 0,69 kV
IEC Ultimate Breaking 36 kA
IEC Service Breaking 36 kA
Individual Pole Breaking 9 kA
ID Bus3
Amp Loading 217,3 A
Voltage 100 %
kW Loading 150,5 kW
1,641
Gen Load Cable
Length 25 m
Amp Flow 217,3 A
% Loading 72,23 %
% Voltage Drop 0,475 %
% PF 100 %
ID Generator Bus
Amp Loading 217,3 A
Voltage 99,53 %
Voltage Angle -0,1 Degrees
kW Loading 149,8 kW
ID Bus4
Amp Loading 217,3 A
Voltage 99,53 %
Voltage Angle -0,1 Degrees
kW Loading 149,8 kW
Length 5 m
Amp Flow 217,3 A
% Loading 72,23 %
% Voltage Drop 0,095 %
% PF 100 %
Silo Supply
2,701 kA -77,7
Bus2
0,4 kV
1,091
ID Bus2
Amp Loading 217,3 A
% Loading 21,725 %
Voltage 99,43 %
Voltage Angle -0,12 Degrees
kW Loading 149,7 kW
Lump1
150 kVA
ID Lump1
kV 0,4 kV
kVA 150 kVA
FLA 216,5 A
PF 100 %

Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 60909 Standard

3-Phase, LG, LL, & LLG Fault Currents

	Swing	V-Control	Load	Total
Number of Buses:	1	0	3	4

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	0	0	0	2	0	1	3

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	1	0	0	0	1	0	2

System Frequency:	50.00
Unit System:	Metric
Project Filename:	Pietermaritzburg Transfer
Output Filename:	C:\ETAP 2400\Pietermaritzburg Transfer\PMB PSCC Gen.SI2S

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Individual	
Cable / Busway Resistance:	Yes	Individual	

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus2	Load	0.400	0.400	1	100.00	0.00
Bus3	SWNG	0.400	0.400	1	100.00	0.00
Bus4	Load	0.400	0.400	1	100.00	0.00
Generator Bus	Load	0.400	0.400	1	100.00	0.00

4 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable/Busway Input Data

ohms or siemens per 1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length									
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
Gen Load Cable	1,0NALN4	185	25.0	0.0	1	75	0.2010503	0.0700000	0.0000880	0.8042012	0.2800000	
Silo Supply	1,0NALN4	185	5.0	0.0	1	75	0.2010503	0.0700000	0.0000880	0.8042012	0.2800000	

Line / Cable / Busway resistances are listed at the specified temperatures.

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
Gen Load Cable	Cable	Bus3	Generator Bus	314.14	109.38	332.64	0.0000004
Silo Supply	Cable	Bus4	Bus2	62.83	21.88	66.53	0.0000001
400A ATS	Tie Switch	Bus4	Generator Bus				

Synchronous Generator Input Data

Synchronous Generator		Rating				% Impedance in Machine Base					Grounding			Excitation
							Xd"							
ID	Type	MVA	kV	RPM	% PF	R	Adj.	Tol.	R/X	Xd, sat	Conn.	Type	Amp	Type
Standby Gen	Diesel	0.200	0.400	1500	85.00	1.000	19.00	0.0	0.05	155.00	Wye	Solid	0.00	Term. Fed, Cyl. 130%

Total Connected Synchronous Generators (= 1,00) : 0,200 MVA

Lumped Load Input Data

	Lumped Load						Motor Loads								
	Rating				% Load		Loading		% Impedance (Machine Base)			Grounding			mFact.
Lumped Load ID	kVA	kV	Amp	% PF	MTR	STAT	kW	kvar	R	X"	R/X"	Conn.	Type	Amp	MW/PP
Lump1	150.0	0.400	216.51	100.00	80	20	120.00	0.00	6.46	15.37	0.42	Delta			0.12

Total Connected Lumped Loads (= 1): 150.0 kVA

SHORT- CIRCUIT REPORT

Fault at bus : **Bus2**

Nominal kV = 0.400 Voltage c Factor = 1.05 (User-Defined)

Line-To-Line-To-Ground Fault

Contribution		% Voltage at From Bus						Current at From Bus (kA)								
From Bus ID	To Bus ID	Va		Vb		Vc		Ia		Ib		Ic		Sequence Current (kA)		
		Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	I1	I2	I0
Bus2	Total	95.46	-6.4	0.00	0.0	0.00	0.0	0.000	0.0	3.025	161.5	2.657	49.0	1.890	0.845	1.057
Bus4	Bus2	94.24	-5.7	2.34	145.4	2.04	111.0	0.440	122.4	2.198	148.8	1.758	55.8	1.148	0.521	1.057
Lump1	Bus2	105.00	0.0	105.00	-120.0	105.00	120.0	0.440	-57.6	1.005	-169.7	0.934	36.2	0.763	0.331	0.000
Bus3	Generator Bus	88.33	-2.0	14.07	145.4	12.22	111.0	0.440	122.4	2.198	148.8	1.758	55.8	1.148	0.521	1.057

\# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta-Y transformer

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus2	0.400	2.701	5.659	0.542	2.972	6.228	2.972	2.972	2.377	4.980	2.377	2.377	3.025	6.338	3.025	3.025

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus2	0.400	0.01909	0.08772	0.08977	0.02126	0.08431	0.08695	0.03176	0.06185	0.06953	0.00000	0.00000	0.00000

Branch (earth-fault factor) Summary Report

Bus		EFF/Ke (LG)	EFF/Ke (LLG)
ID	kV		
Bus2	0.400	1.07	0.95

ANNEXURE E

COCs and Electrical Test Report

Certificate of Compliance & Test Report

SANS 10142-1:2024 (Edition 3.2)

MIE Electrical (Pty) Ltd
Master Installation Electrician – Reg No: MIE 1982

Certificate of Compliance – Cover

Date of issue: 2025/11/01

User / Lessor (Client): Afgri Grain Management

Installation physical address: 86 Ohrtmann road, Willowton, Pietermaritzburg, 3201

Description of installation covered by this CoC: New additions to existing installation

CoC Category & Description

- [ ] New installation
- [x] Addition / alteration
- [ ] Existing installation (verification)

Details of the categories selected: C4, C17, C18, RIO 1, RIO 2, RIO 3, RIO 4 Supply Generator Installation

Registered person details

Registered person name: Martin Erasmus

Registration certificate number: MP00502/MIE 1982

Contact number: 0712994344

Signature of registered person (MIE 1982)
Sign on printout or with a digital signature tool.

Client / user acknowledgement
Optional if handled by separate acceptance document.

CoC QR code (unique per CoC No / site)

QR link / document URL (optional): https://mieelectrical.co.za/documents/clients/afgri/Pietermaritzburg/Transfer Upgrade/Handover.pdf

If a URL is entered above, the QR will open that address. If left blank, it encodes CoC details as text.

Test report for all electrical installations

This report is used together with the Certificate of Compliance and covers only the part of the installation described in Section 3 below.

Section 1 – Location (only required if not on CoC)

Physical address

See above

Name of building / facility

Silo Complex

Section 2 – Installation details

Nature of installation

- [x] Permanent installation
- [ ] Temporary installation
- [ ] Common area for multiple users

Type of supply system

- [ ] TN-S
- [x] TN-C-S
- [ ] TN-C
- [ ] TT
- [ ] IT

Supply characteristics

Nominal voltage (V)

400V

Number of phases: Three phase

Phase rotation: Clockwise

Main switch / point of control

Type: Circuit-breaker

Current rating (A)

300

Short-circuit withstand (kA)

36

Alternative sources and special installations

- [ ]
- [x] Alternative supply (generator / PV / UPS

Special installations (medical, hazardous, etc.)

- [ ] Part of installation > 1 kV

Additional notes (special supplies, transformers, etc.)

New Standby Generator

Protection features installed

- [ ] Surge protection devices (SPDs)
- [ ]

External lightning protection system

- [ ] RCD / earth leakage protection

Multiple installations on same new supply

- [ ] This new point of supply serves five or more separate users

SECTION 3 – DESCRIPTION OF INSTALLATION COVERED BY THIS REPORT

(Add additional pages, specification references or drawings, etc., where applicable)

General description of the part of the installation covered by this report.

Number of circuits or points

Number of circuits or points	New	Existing	Number of circuits or points	New	Existing
Motor Circuits	3				
Motor Control Circuits	3				
Remote I/O Circuits	4				
Direction Control Valves c	34				
Alternative Power Supply	1				

Number of circuits or points	New	Existing	Number of circuits or points	New	Existing

Section 4 – Inspection and tests (tick list – new and existing)

Mark each item as compliant (Yes), not compliant (No) or not applicable (N/A) for the part of the installation covered.

No.	Inspection / test item	Yes	No	N/A
1	Conductor sizes suitable for protective devices and connected loads	☑	☐	☐
2	Equipment and accessories correctly selected and installed	☑	☐	☐
3	Devices for isolation and switching correctly positioned and identified	☑	☐	☐
4	Protection against direct contact provided where required	☑	☐	☐
5	Fault protection and disconnection times adequate for the system	☑	☐	☐
6	Equipotential bonding and earthing present where required	☑	☐	☐
7	Conductors, terminations and connections mechanically sound	☑	☐	☐
8	Cables correctly routed, protected and supported	☑	☐	☐
9	External influences (moisture, corrosion, temperature, etc.) adequately considered	☑	☐	☐
10	Labelling, identification and notices provided where required	☑	☐	☐
11	Access, emergency routes and operational safety acceptable	☑	☐	☐
12	Testing points and test facilities available where necessary	☑	☐	☐
13	Polarity of points of consumption correct	☑	☐	☐
14	Phase rotation consistent at three-phase points of consumption	☑	☐	☐
15	All switching devices operate correctly (make and break)	☑	☐	☐

Comments on inspection and parts not covered by this report

Detailed measured test results (optional)

Use this section to record representative measured values for earth continuity, loop impedance, PSCC, insulation resistance, voltages, etc.

No.	Test description	Unit	Result / Reading	Comments / location
1	Continuity of protective & bonding conductors	Ω	0,13	
2	Earth continuity resistance at representative points	Ω	0,13	
3	Ring circuit continuity (where applicable)	Ω	N/A	
4	Earth loop impedance at main / local switch	Ω	0,14	
5	Prospective short-circuit current at point of control	kA	2,7	
6	Voltage between incoming neutral & external earth	V	10mV	
7	Earth electrode resistance (where required)	Ω	N/A	
8	Insulation resistance – main circuits	MΩ	Infinity	
9	Voltages at DB – no load (phase to neutral)	V	233	
10	Voltages at DB – full calculated load (phase to neutral)	V	228	
11	Earth leakage tripping current (IΔn) & operation	mA	N/A	
12	Earth leakage test buttons – functional	–	N/A	
13	Polarity of points of consumption	–	Correct	

No.	Test description	Unit	Result / Reading	Comments / location
14	Phase rotation at three-phase outlets	–	AC Clockwise/DC Consist	
15	All switching devices – make / break function	–	Correct	

Comments or reference to attached detailed test sheets

Test equipment used for this report

Instrument	Manufacturer & model	Serial number	Calibration certificate / expiry
Etap	Etap	Confidential	Etap 24.03

Supporting documentation for this report

Document	Attached	Not applicable	Attachment No.	No. of pages
Copy of CoC relating to this report	☑	☐	Annexure E	4
Single line diagrams and DB schedules	☑	☐	Annexure C	42
Test sheets / detailed measurements	☑	☐	Annexure D	26

Section 5 – Responsibility

The registered person below confirms that the inspection and tests recorded on this report were carried out in accordance with SANS 10142-1 for the part of the installation described in Section 3.

Name of registered person: Martin Erasmus

Registration certificate number: MIE 1982/MP00502

Date: 2017/05/08

Additional responsibility where supply serves 5 or more users

Name of person taking overall responsibility: N/A

Capacity / competency: N/A

Registration number (if applicable): n/A

Business address: 38 Annie Road Witbank 1042

Date: 2025/12/16

ANNEXURE F

OEM Manual, Training and Instructions

UNO-PS/1AC/24DC/ 60W

Primary-switched power supply unit

Data sheet
105547_en_03

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1 Description

The UNO POWER power supply unit impresses in worldwide use thanks to maximum energy efficiency. Low idling losses and the high degree of efficiency save energy.

Thanks to its high power density, the UNO POWER power supply unit is the ideal solution, particularly in compact control boxes.

Features

- Worldwide use thanks to input voltage range of 85 V AC ... 264 V AC
- Superior system availability through reliable power supply with 24 V DC
- Maximum energy efficiency thanks to optimized efficiency over the entire operating range of the power supply unit and low idling losses
- Particularly compact: 60 W of power from this narrow power supply, which is just 35 mm wide
- Short-circuit-proof and idling-proof

Technical data (short form)	
Input voltage range	85 V AC ... 264 V AC
Mains buffering	> 20 ms (120 V AC) > 85 ms (230 V AC)
Nominal output voltage (U_N)	24 V DC ±1 %
Nominal output current (I_N)	2.5 A (-25 °C ... 55 °C)
Output power (P_N)	60 W
Efficiency (for nominal values)	typ. 88 % (120 V AC) typ. 90 % (230 V AC)
Residual ripple	< 30 mV_{PP}
MTBF (IEC 61709, SN 29500)	> 785000 h (40 °C)
Ambient temperature (operation)	-25 °C ... 70 °C > 55 °C Derating: 2.5 %/K
Dimensions W/H/D	35 mm / 90 mm / 84 mm
Weight	0.2 kg

Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.net/products.

2 Table of contents

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3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Primary-switched UNO POWER power supply for DIN rail mounting, input: 1-phase, output: 24 V DC/60 W	UNO-PS/1AC/24DC/ 60W	2902992	1

Accessories	Type	Order No.	Pcs./Pkt.
Redundancy module, 5 V - 24 V DC, 2 x 10 A, 1 x 20 A.	UNO-DIODE/5-24DC/2X10/ 1X20	2905489	1
Multi-channel electronic device circuit breaker for protecting four loads at 24 V DC in the event of overload and short circuit. With electronic locking of the set nominal currents. For installation on DIN rails.	CBMC E4 24DC/1-4A NO	2906031	1
Multi-channel electronic device circuit breaker for protecting four loads at 24 V DC in the event of overload and short circuit. With electronic locking of the set nominal currents. For installation on DIN rails.	CBMC E4 24DC/1-10A NO	2906032	1
Type 2/3 surge protection, consisting of protective plug and base element, with integrated status indicator and remote signaling for single-phase power supply networks. Nominal voltage 230 V AC/DC.	PLT-SEC-T3-230-FM-UT	2907919	5
Type 3 surge protection, consisting of protective plug and base element, with integrated status indicator and remote signaling for single-phase power supply networks. Nominal voltage 24 V AC/DC.	PLT-SEC-T3-24-FM-UT	2907916	5

Our range of accessories is being continually extended, our current range can be found in the download area.

4 Technical data

Input data	
Nominal input voltage	100 V AC ... 240 V AC
Input voltage range	85 V AC ... 264 V AC
Frequency range (f_N)	50 Hz ... 60 Hz ±5 Hz
Current consumption (for nominal values) typ.	1.3 A (100 V AC) 0.6 A (240 V AC)
Inrush current limitation (at 25°C) typ.	< 30 A
I^2t typ.	< 0.5 A^2s
Typical response time	< 1 s
Mains buffering	> 20 ms (120 V AC) > 85 ms (230 V AC)
Protective circuit	Transient surge protection Varistor
Input fuse, integrated	2.5 A (slow-blow, internal)
Choice of suitable circuit breakers Characteristics B, C, D, K	6 A ... 16 A

Input connection data	
Connection method	Screw connection
Conductor cross section, solid	0.2 mm^2 ... 2.5 mm^2
Conductor cross section, flexible	0.2 mm^2 ... 2.5 mm^2
Conductor cross section AWG/kcmil	24 ... 14
Stripping length	8 mm
Screw thread	M3
Tightening torque	0.5 Nm ... 0.6 Nm

Output data	
Nominal output voltage (U_N)	24 V DC ±1 %
Nominal output current (I_N)	2.5 A (-25 °C ... 55 °C)
Derating	55 °C ... 70 °C (2.5%/K)
Control deviation	< 1 % (change in load, static 10 % ... 90 %) < 2 % (Dynamic load change 10 % ... 90 %, 10 Hz) < 0.1 % (change in input voltage ±10 %)
Rise time	< 0.5 s (U_{OUT} (10 % ... 90 %))
Residual ripple	< 30 mV_{PP} (with nominal values)
Connection in parallel	yes, with redundancy module
Connection in series	yes
Protection against surge voltage on the output	≤ 35 V DC
Feedback resistance	< 35 V DC

Output connection data	
Connection method	Screw connection
Conductor cross section, solid	0.2 mm² ... 2.5 mm²
Conductor cross section, flexible	0.2 mm² ... 2.5 mm²
Conductor cross section AWG/kcmil	24 ... 14
Stripping length	8 mm
Screw thread	M3
Tightening torque	0.6 Nm ... 0.8 Nm

Power consumption	
Efficiency (for nominal values) typ.	88 % (120 V AC) / 90 % (230 V AC)
Maximum power dissipation in no-load condition	< 0.3 W
Power loss nominal load max.	< 7 W

General data	
Insulation voltage input/output	4 kV AC (type test) 3 kV AC (routine test)
MTBF (IEC 61709, SN 29500)	> 785000 h (40 °C)
Housing material	Polycarbonate
Foot latch material	POM (Polyoxymethylen)
Inflammability class in acc. with UL 94 (housing / terminal blocks)	V0
Degree of protection	IP20
Protection class	II (in closed control cabinet)
Dimensions W/H/D	35 mm / 90 mm / 84 mm
Weight	0.2 kg

Ambient conditions	
Ambient temperature (operation)	-25 °C ... 70 °C (> 55 °C Derating: 2.5 %/K)
Ambient temperature (start-up type tested)	-40 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	≤ 95 % (at 25 °C, non-condensing)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm (according to IEC 60068-2-6) 15 Hz ... 150 Hz, 2.3g, 90 min.
Shock	18 ms, 30g, in each space direction (according to IEC 60068-2-27)
Degree of pollution	2
Climatic class	3K3 (in acc. with EN 60721)

Standards	
Safety of power supply units up to 1100 V (insulation distances)	EN 61558-2-16
Electrical safety (of information technology equipment - Safety - Part 1)	IEC 60950-1/VDE 0805 (SELV)
Electronic equipment for use in electrical power installations	EN 50178/VDE 0160 (PELV)
SELV	IEC 60950-1 (SELV) and EN 60204-1 (PELV)
Safe isolation	DIN VDE 0100-410
Limitation of mains harmonic currents	EN 61000-3-2
Network version/undervoltage	EN 61000-4-11
Information technology equipment - Safety (CB Scheme)	CB Scheme

Approvals	
UL approvals	UL/C-UL listed UL 508 UL/C-UL Recognized UL 60950-1 NEC Class 2 as per UL 1310 UL/C-UL Listed ANSI/ISA-12.12.01 Class I, Division 2, Groups A, B, C, D T4A (Hazardous Location)
CSA	CAN/CSA-C22.2 No. 60950-1-07 CSA-C22.2 No. 107.1-01 CAN/CSA-C22.2 No. 213 Class I, Division 2, Groups A, B, C, D T4A (Hazardous Location)

Current approvals/permissions for the product can be found in the download area under phoenixcontact.net/products

Conformance with EMC Directive 2014/30/EU		
Noise immunity according to EN 61000-6-2		
	EN 61000-6-2 requirement	**tested**
Electrostatic discharge EN 61000-4-2		
Housing contact discharge	4 kV (Test Level 2)	6 kV (Test Level 3)
Housing air discharge	8 kV (Test Level 3)	8 kV (Test Level 3)
Comments	Criterion B	Criterion B
Electromagnetic HF field EN 61000-4-3		
Frequency range	80 MHz ... 1 GHz	80 MHz ... 1 GHz
Test field strength	10 V/m	10 V/m
Frequency range	1.4 GHz ... 2 GHz	1 GHz ... 2 GHz
Test field strength	3 V/m	10 V/m
Frequency range	2 GHz ... 2.7 GHz	2 GHz ... 3 GHz
Test field strength	1 V/m	10 V/m
Comments	Criterion A	Criterion A
Fast transients (burst) EN 61000-4-4		
Input	2 kV (Test Level 3 - asymmetrical)	4 kV (Test Level 4 - asymmetrical)
Output	2 kV (Test Level 3 - asymmetrical)	2 kV (Test Level 3 - asymmetrical)
Comments	Criterion B	Criterion A
Surge current loads (surge) EN 61000-4-5		
Input	1 kV (Test Level 2 - symmetrical) 2 kV (Test Level 3 - asymmetrical)	2 kV (Test Level 3 - symmetrical) 4 kV (Test Level 4 - asymmetrical)
Output	0.5 kV (Test Level 1 - symmetrical) 0.5 kV (Test Level 1 - asymmetrical)	1 kV (Test Level 2 - symmetrical) 2 kV (Test Level 3 - asymmetrical)
Comments	Criterion B	Criterion A
Conducted interference EN 61000-4-6		
Frequency range	10 kHz ... 80 MHz	150 kHz ... 80 MHz
Voltage	10 V (Test Level 3)	10 V (Test Level 3)
Comments	Criterion A	Criterion A

Key	
Criterion A	Normal operating behavior within the specified limits.
Criterion B	Temporary impairment to operational behavior that is corrected by the device itself.

Emitted interference in acc. with EN 61000-6-3	
Radio interference voltage in acc. with EN 55011	EN 55011 (EN 55022) Class B, area of application: Industry and residential
Emitted radio interference in acc. with EN 55011	EN 55011 (EN 55022) Class B, area of application: Industry and residential

All technical specifications are nominal values and refer to a room temperature of 25 °C and 70 % relative humidity at 100 m above sea level.

5 Intended use

This power supply unit features IP20 protection and is intended for installation in housing. It is suitable for use in industrial applications.

6 Structure

6.1 Device elements

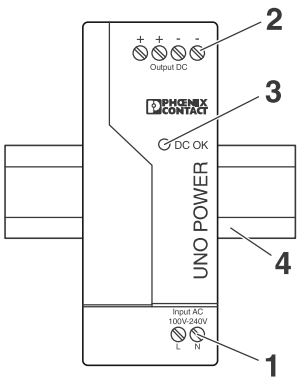


Figure 1 Device elements

1. Connection terminal block input voltage: Input AC L/N
2. Connection terminal block output voltage: Output DC +/-
3. LED signaling DC OK (green)
4. Integrated snap-on foot for carrier rail mounting

6.2 Block diagram

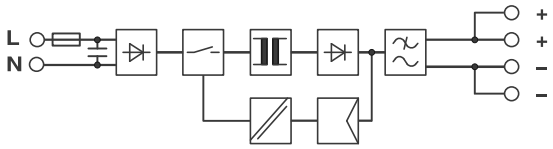


Figure 2 Block diagram

Element	Meaning
	Fuse
	Rectification
	Switch
	Transformer
	Filter
	Electrically isolated signal transmission
	Regulation

7 Mounting

7.1 Unpacking

Before mounting the power supply unit, it must be checked for damage:

- Take the device out of its packaging.
- Check the device for any damage sustained during transport.
- Retain the package slip for future use.
- Dispose of packaging in an environmentally-friendly way.

7.2 Mounting the power supply unit

The power supply unit is intended for installation in a distributor box or control cabinet.

The power supply unit is designed for convection cooling. Maintain a minimum distance from other devices in order to ensure convection cooling.

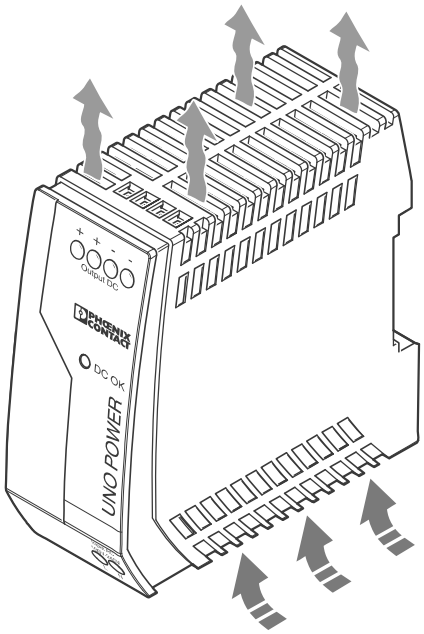


Figure 3 Convection

Please note the following before mounting the power supply unit:

– The minimum distance from other devices that must be observed in order to ensure convection cooling is: 30 mm vertically, 0 mm horizontally

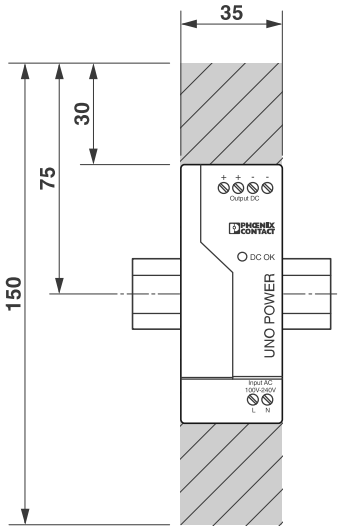


Figure 4 Device dimensions and dead surfaces

– The device dimensions

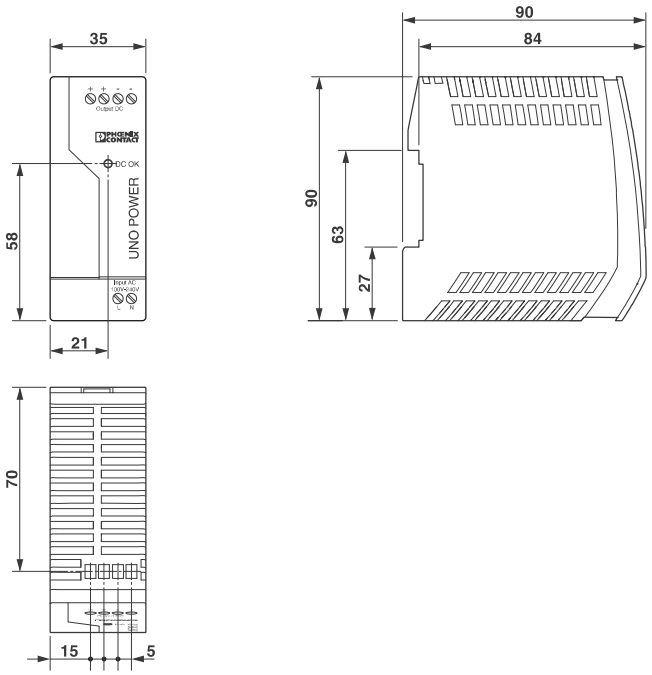


Figure 5 Device dimensions

7.3 Mounting on a DIN rail

The power supply unit can be installed on all 35 mm DIN rails according to EN 60715.

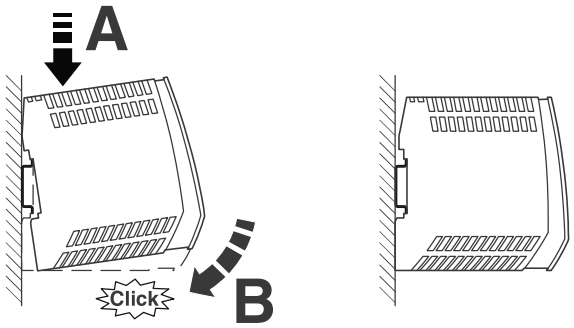


Figure 6 Mounting on a DIN rail

7.4 Normal mounting position

When installed, the input terminal blocks must be at the bottom and the output terminal blocks at the top.

If the power supply unit is installed in a mounting position other than the normal mounting position, the output power must be reduced.

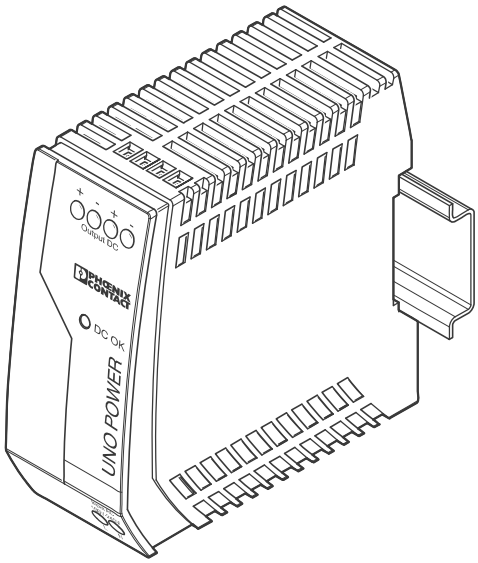


Figure 7 Normal mounting position

8 Installing the power supply unit

8.1 Safety regulations and installation notes

Before startup please ensure:

– Only skilled persons may install, start up, and operate the device.
– Observe the national safety and accident prevention regulations.

WARNING: Danger to life by electric shock!

– Never carry out work when voltage is present.
– Establish mains connection correctly and ensure protection against electric shock.
– The device must be switched off outside the power supply in accordance with the regulations of EN 60950-1 (e.g., by means of line protection on the primary side).
– Cover termination area after installation in order to avoid accidental contact with live parts (e. g., installation in control cabinet).
– Protect the device against foreign bodies penetrating it, e.g., paper clips or metal parts.

NOTE: Danger if used improperly

– The device is a built-in device.
– The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. Do not subject the device to any load that exceeds the described limits.
– Observe mechanical and thermal limits.
– Ensure that the primary-side wiring and secondary-side wiring are the correct size and have sufficient fuse protection.

– It is not permissible to open or modify the device. Do not repair the device yourself but replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.
– The device may only be used for its intended use.

8.2 High-voltage test (HIPOT)

This protection class II power supply is subject to the Low Voltage Directive and is factory tested. During the HIPOT test (high-voltage test), the insulation between the input circuit and output circuit is tested for the prescribed electric strength values, for example. The test voltage in the high-voltage range is applied at the input and output terminal blocks of the power supply. The operating voltage used in normal operation is a lot lower than the test voltage used.

The test voltage should rise and fall in ramp form. The relevant rise and fall time of the ramp should be at least two seconds.

8.2.1 High-voltage dielectric test (dielectric strength test)

In order to protect the user, power supplies (as electric components with a direct connection to potentially hazardous voltages) are subject to more stringent safety requirements. For this reason, permanent safe electrical isolation between the hazardous input voltage and the touch-proof output voltage as safety extra-low voltage (SELV) must always be ensured.

In order to ensure permanent safe isolation of the AC input circuit and DC output circuit, high-voltage testing is performed as part of the safety approval process (type test) and manufacturing (routine test).

8.2.2 High-voltage dielectric test during the manufacturing process

During the manufacturing process for the power supply, a high-voltage test is performed as part of the dielectric test in accordance with the specifications of IEC/UL/EN 60950-1. The high-voltage test is performed with a test voltage of at least 3 kV AC / 4.3 kV DC or higher. Routine manufacturing tests are inspected regularly by a certification body.

8.2.3 High-voltage dielectric test performed by the customer

Apart from routine and type tests to guarantee electrical safety, the end user does not have to perform another high-voltage test on the power supply as an individual component. According to EN 60204-1 (Safety of machinery - Electrical equipment of machines) the power supply can be disconnected during the high-voltage test and only installed once the high-voltage test has been completed.

8.2.4 Performing high-voltage testing

If high-voltage testing of the control cabinet or the power supply as a stand-alone component is planned during final inspection and testing, the following features must be observed.

– The power supply wiring must be implemented as shown in the wiring diagram.
– The maximum permissible test voltages must not be exceeded.

Avoid unnecessary loading or damage to the power supply due to excessive test voltages.

For the relevant applicable test voltages and insulation distances, refer to the corresponding table (see technical data).

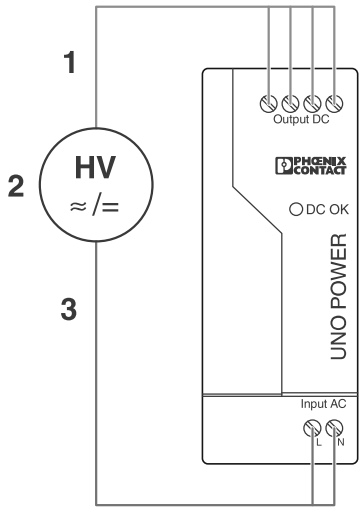


Figure 8 Potential-related wiring for the high-voltage test

Key

No.	Designation	Color coding	Potential levels
1	DC output circuit	Blue	Potential 2
2	High-voltage tester	--	--
3	AC input circuit	Red	Potential 1

8.3 Mains connection

The device can be connected to single-phase AC or three-phase power grids (TN-S, TN-C, TT, and IT) while considering the nominal input voltage.

For operation on two of the phase conductors of a three-phase system, an isolating facility for all poles must be provided.

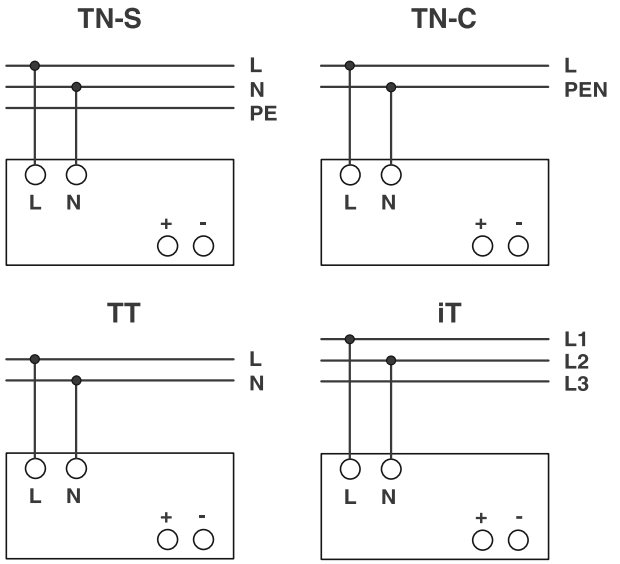


Figure 9 Network types

8.4 Device connections

Screw connection for input AC L/N

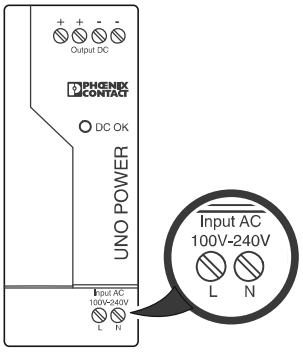


Figure 10 Screw connection for input AC L/N

Screw connection for output DC +/-

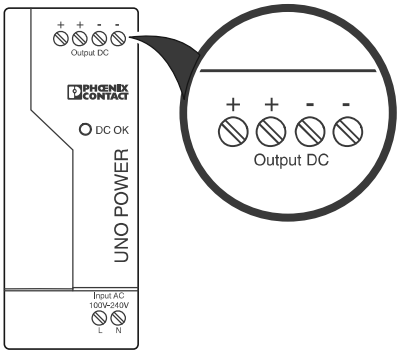


Figure 11 Screw connection for output DC +/-

8.5 Connecting cables

Use copper cables with an operating temperature > 75°C (ambient temperature < 55°C) and > 90°C (ambient temperature < 75°C).

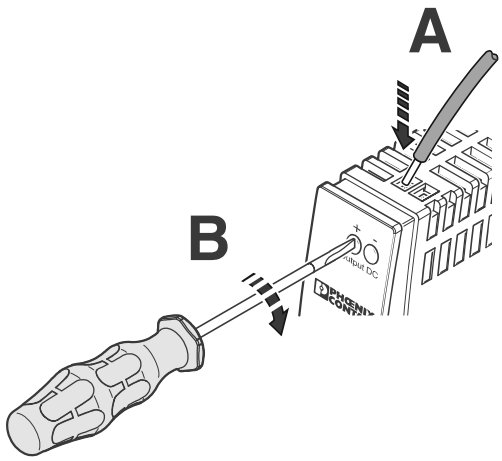


Figure 12 Connecting cables

1. Connect the supply lines to the input AC L/N connection terminal blocks.
2. Connect the output cables to the output DC +/- connection terminal blocks.

The power supply unit is operational as soon as the input terminal blocks are supplied with voltage.

9 Operating behavior of the power supply unit

9.1 Normal operation

In normal operation, the loads are supplied with a constant output voltage of 24 V DC.

9.2 Overload response

In the event of overload ($I > I_N$), the device reduces its output voltage. If the output voltage is greater than U_N x 0.9, the green DC OK LED lights up. If the output voltage drops below U_N x 0.5, the device shuts down. After a short time, the device attempts to start up again. If the overload has been rectified, it will start up as normal. If the overload has still not been rectified, it will shut down again and attempt to restart again (automatic restart).

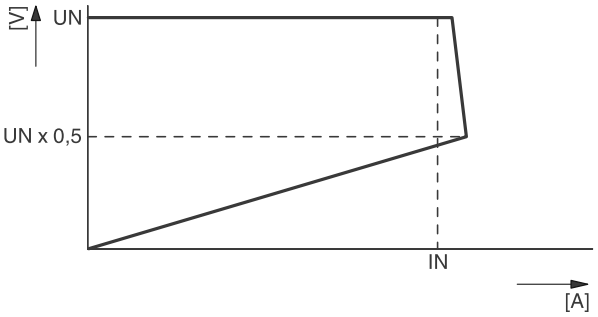


Figure 13 Output characteristic curve

9.3 Behavior at ambient temperatures > 55°C

At an ambient temperature of up to 55 °C, the power supply unit supplies the nominal output current. At ambient temperatures upwards of 55 °C, the output power must be reduced by 2.5 % per Kelvin temperature increase (temperature-dependent derating).

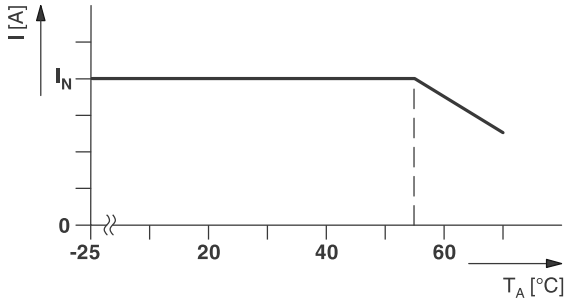


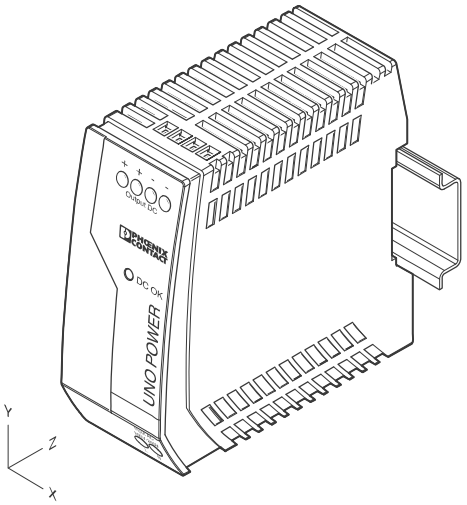
Figure 14 Temperature-dependent derating

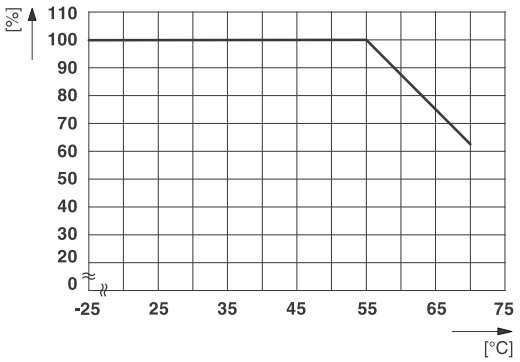
9.4 Behavior in the case of alternative mounting positions

For mounting positions that differ from the normal mounting position, the output power must be reduced (position-dependent derating).

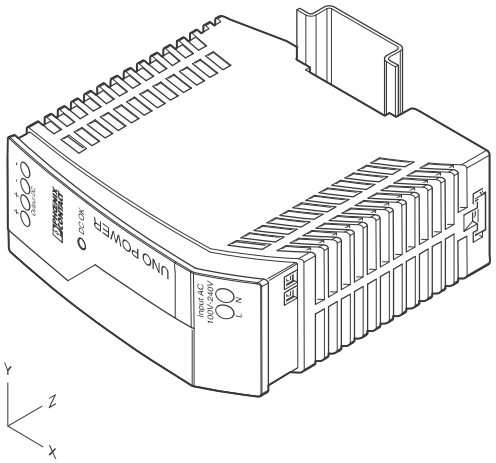
The characteristic curve can be used to determine the maximum output power to be drawn for each ambient temperature for different mounting positions.

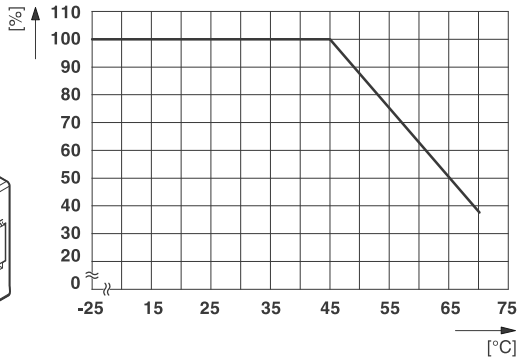
Normal mounting position



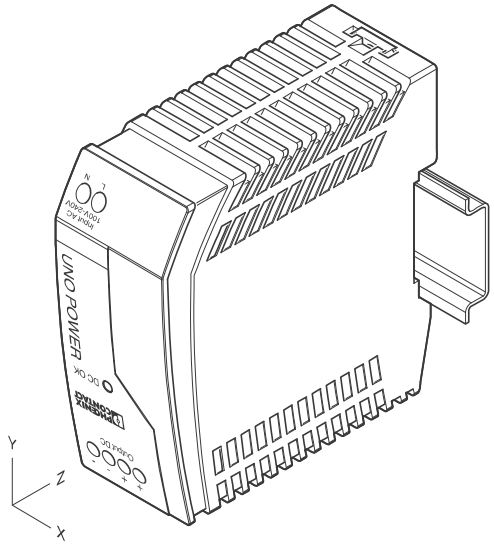


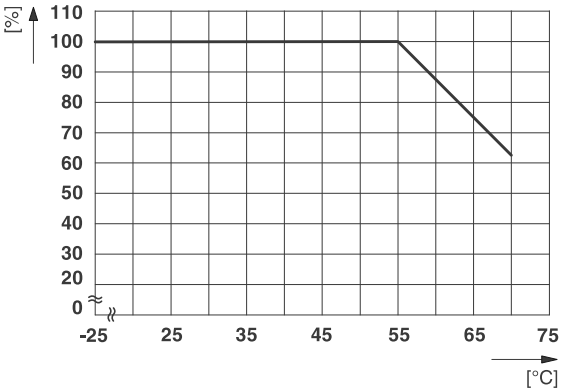
Rotated mounting position 90° X-axis



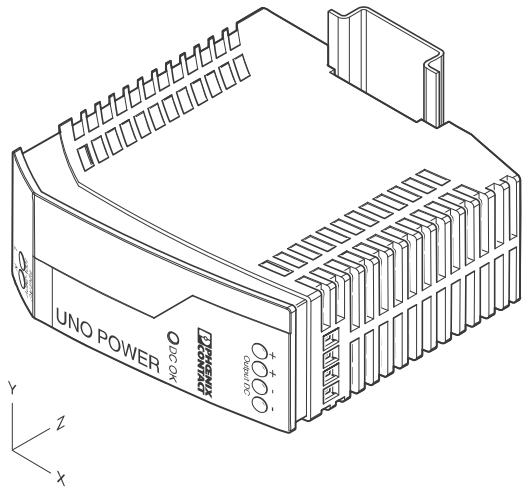


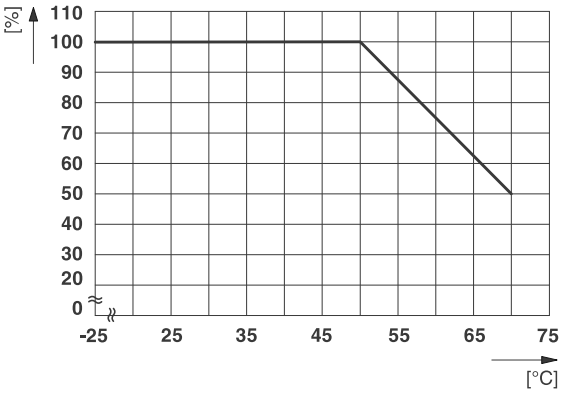
Rotated mounting position 180° X-axis



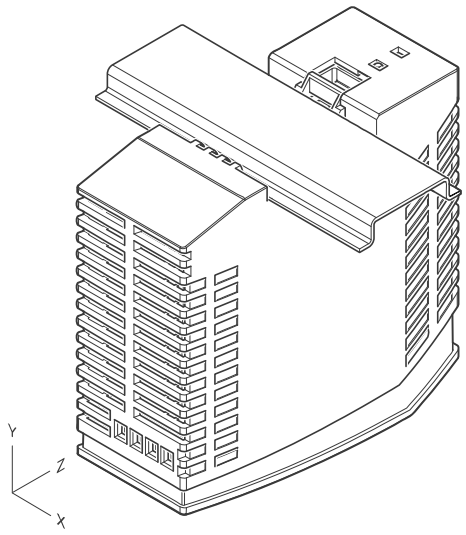


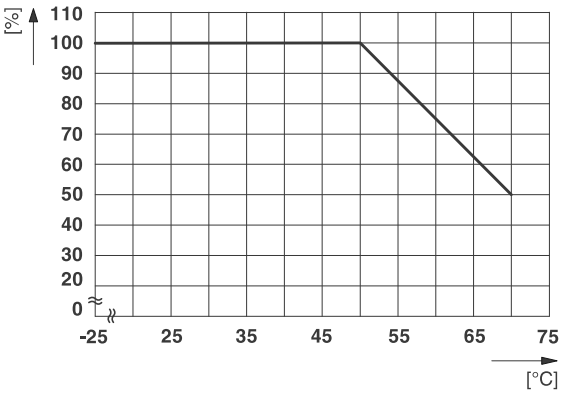
Rotated mounting position 270° X-axis



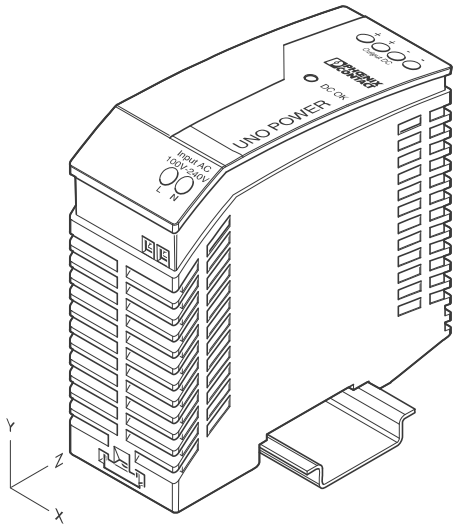


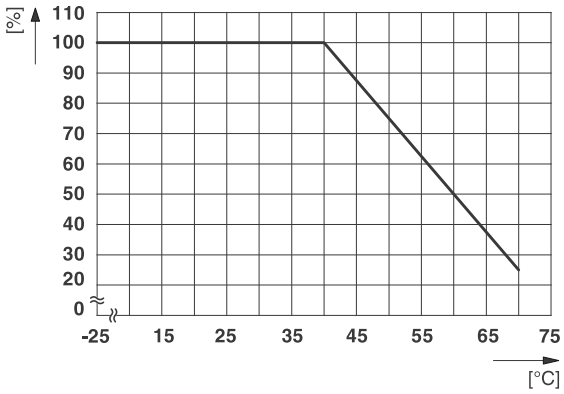
Rotated mounting position 90° Z-axis





Rotated mounting position 270° Z-axis





10 Operating the power supply unit

10.1 Function monitoring

DC OK LED

The DC OK LED is available for visual function monitoring of the power supply unit.

	Status 1	Status 2
DC OK LED	lit	off
Meaning	Output voltage > 21.5 V	Output voltage < 21.5 V DC, overload mode or no mains voltage
State description	The device is operating, output voltage and output current are OK	The device is in operation, but there is a fault on the side of the consumer; the current consumption is greater than IN or the output is short-circuited. The device is out of operation because there is no mains voltage, the fuse on the primary side has been triggered, or the device is faulty.
Corrective		Remove the error at the load, use a more powerful power supply unit, connect a power supply unit of the same type parallel to the existing device, remove the short circuit, apply mains voltage, enable the fuse again or replace the power supply unit.

10.2 Operating power supply units in parallel

Power supply units of the same type can be connected in parallel to increase both redundancy and power.

To ensure symmetrical current distribution, all cable connections from the power supply unit to the busbar must be the same length and have the same conductor cross section.

Redundant operation

Redundant circuits are suitable for supplying systems which place particularly high demands on operational safety. If a fault occurs in the primary circuit of the first power supply unit, the second device automatically takes over the complete power supply without interruption, and vice versa.

Using a redundancy module, it is possible for two power supply units of the same type that are connected in parallel on the output side for redundancy to be decoupled from one another.

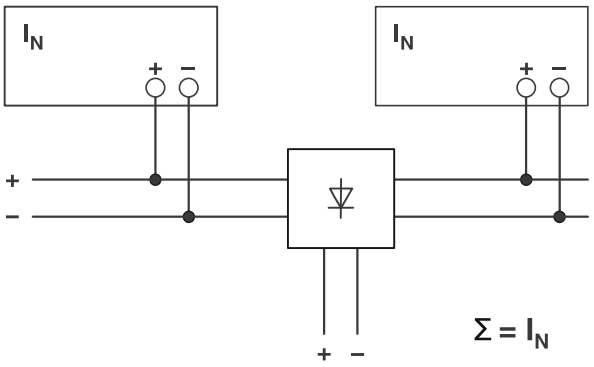


Figure 15 Redundant circuit with redundancy module

Increased performance

Power supply units of the same type can be connected in parallel to increase the power to n x I_N. Parallel connection is recommended if existing systems are to be extended and the power supply unit that is installed here does not cover the current consumption of the most powerful load. Otherwise, the loads should be distributed between individual devices that are independent of one another.

Using a redundancy module, it is possible for two power supply units of the same type that are connected in parallel on the output side to increase power to be decoupled from one another.

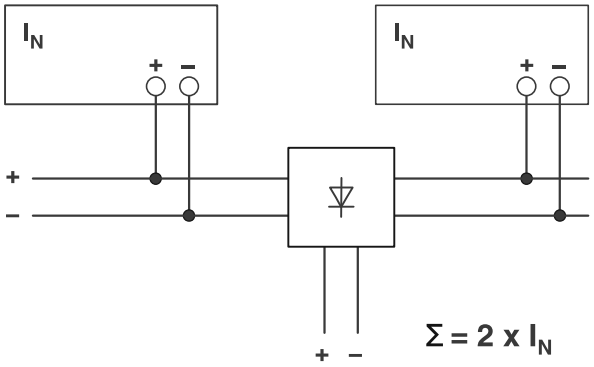


Figure 16 Parallel connection to increase power with a redundancy module

10.3 Operating the power supply unit in series

Two devices can be connected in series to double the voltage. Only power supply units of the same type should be connected in series. Series connection should always be used when the output voltage of the module is not sufficient. For example, devices with 24 V DC nominal output voltage each supply 48 V DC in series. Depending on the specification of functional earth ground, output voltages of + 48 V/-48 V as well as ±24 V DC can also be made available.

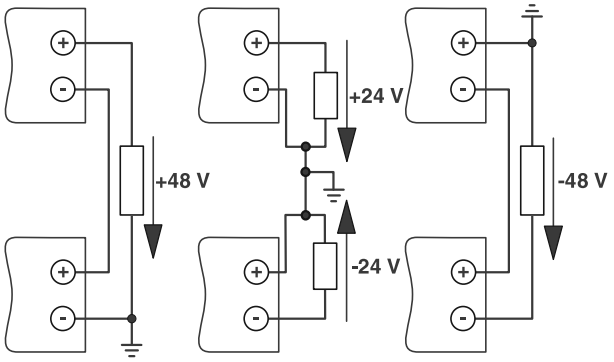


Figure 17 Series operation

11 Removal

11.1 Removing the power supply unit

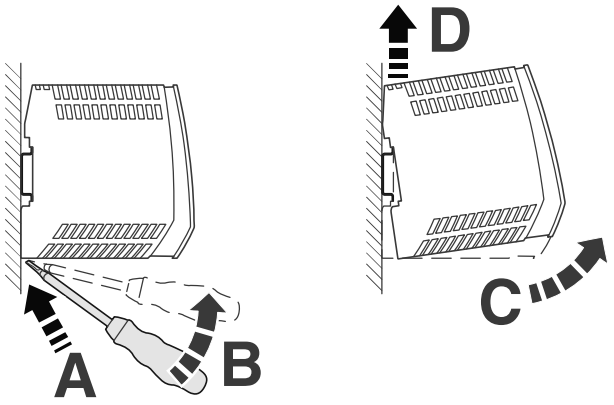


Figure 18 Removal

11.2 Notes on disposal

Do not dispose of the power supply unit with household waste. It should be disposed of in accordance with the currently applicable national regulations.

AXL F BK PN TPS

Axioline F, bus coupler, PROFINET

Data sheet
107621_en_11

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1 Description

The bus coupler is intended for use within a PROFINET network.
The bus coupler creates the link to the Axioline F I/O system and the industrial I/O signals connected to it.
Up to 63 Axioline F devices can be connected to the bus coupler.
Device descriptions for Phoenix Contact controllers are integral parts of the engineering tools PC Worx and PLCnext Engineer.
Corresponding GSDML files are available for integrating the Axioline F station into other programming systems. These files can be downloaded at:
www.phoenixcontact.com/product/2403869

Valid for firmware revision 1.xx

Features

- 2 Ethernet ports (with integrated switch)
- Conformance with PROFINET specification V2.3
- Supports PROFIsafe
- Supports PROFIenergy
- Supports PROFINET S2 system redundancy (firmware version 1.30 or later)
- PROFINET RT and IRT
- Minimum cycle time of PROFINET for RT and IRT is 250 µs
- Firmware can be updated
- Runtime in bus coupler is negligible (almost 0 µs)
- Typical cycle time of the Axioline F local bus is around 10 µs
- Web-based management
- Supports the operation of Axioline Smart Elements
- Supports passive Smart Elements (firmware version 1.30 or later)
- Supports IOL-CONF (firmware version 1.30 and later)
- Supports Diag+
- Safe analog value processing with SAFE AI and other components

This data sheet is only valid in association with the UM EN AXL F SYS INST user manual.
For information on PROFINET basics, please refer to the UM EN PROFINET SYS user manual.

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.com/product/2403869

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3 Ordering data

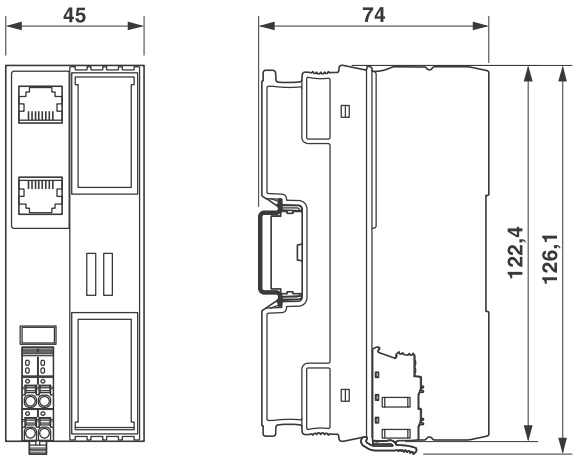
Description	Type	Item no.	Pcs./Pkt.
Axioline F, Bus coupler, PROFINET, RJ45 jack, transmission speed in the local bus: 100 Mbps, degree of protection: IP20, including bus base module and Axioline F connector	AXL F BK PN TPS	2403869	1

Documentation	Type	Item no.	Pcs./Pkt.
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-
User manual, English, PROFINET basics	UM EN PROFINET SYS	-	-
Quick start guide, English, Handling an Axioline F station under Startup+	UM QS EN STARTUP+	-	-
Application note, English, Protection of the FTP access on bus couplers	AH EN AXL F BK - SECURITY ADVISORY	-	-
Application note, English, Measures to protect network-capable devices with Ethernet connection against unauthorized access	AH EN INDUSTRIAL SECURITY	-	-
User manual, English, Installation and operation of the PC Worx Firmware Updater software	UM EN PC WORX FIRMWARE UPDATER	-	-
Quick start guide, English, Startup of IO-Link masters and IO-Link devices with the IOL-CONF software	UM QS EN AXL F IOL CONF	-	-
Application note, English, Description of the SAFE AI system	AH EN SAFE AI	-	-

Additional ordering data	
For additional ordering data (accessories), go to:	www.phoenixcontact.com/product/2403869

4 Technical data

Dimensions (nominal sizes in mm)	



Width	45 mm
Height	126.1 mm
Depth	74 mm
Note on dimensions	The depth applies when a TH 35-7.5 DIN rail is used (in accordance with EN 60715).

General data	
Color	Housing: traffic grey A (RAL 7042)
Weight	177 g (with connector and bus base module)
Ambient temperature (operation)	-25 °C ... 60 °C (Mounting position: wall mounting on horizontal DIN rail) -25 °C ... 55 °C (Mounting position: any)
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Overvoltage category	II (IEC 60664-1, EN 60664-1)
Degree of pollution	2 (IEC 60664-1, EN 60664-1)
Mounting type	DIN rail mounting
Mounting position	any (observe temperature derating)

Connection data: Axioline F connector	
Connection method	Push-in connection
Conductor cross section, rigid	0.2 mm² … 1.5 mm²
Conductor cross section, flexible	0.2 mm² … 1.5 mm²
Conductor cross section [AWG]	24 … 16
Stripping length	8 mm

Please observe the information provided on conductor cross sections in the “Axioline F: system and installation” user manual.

Interface: PROFINET	
Number of interfaces	2
Connection method	RJ45 jack (Auto negotiation and autocrossing)
Transmission speed	100 Mbps (full duplex)
Transmission physics	Ethernet in RJ45 twisted pair
Transmission length	max. 100 m

Interface: Axioline F local bus	
Number of interfaces	1
Connection method	Bus base module
Transmission speed	100 Mbps

Interface: Service	
Number of interfaces	1
Connection method	USB type C

System limits of the bus coupler	
Amount of process data	max. 1012 Byte (Input) max. 1012 Byte (Output)

Use the Project+ configuration software to calculate the individual process or parameter data and the corresponding number of devices that can be connected.

For the Project+ configuration software, go to: www.phoenixcontact.com/product/2403869

Number of local bus devices that can be connected	max. 63
Number of IO-Link masters	max. 8

NOTE: Electronics may be damaged when overloaded

Observe the logic current consumption of each device when configuring an Axioline F station. It is specified in every module-specific data sheet. The current consumption can differ depending on the individual module. The permissible number of devices that can be connected therefore depends on the specific station structure.

PROFINET	
Device function	PROFINET device
Specification	Version 2.3
Conformance Class	Conformance-Class C
Vendor ID	$00B0_{hex}$
Device ID	1000_{hex}

Supported protocols	
Supported protocols	PROFINET, TFTP, PTCP, LLDP, SNMP, MRP, DCP, DDI, BootP (BootP only to perform firmware updates)

Communications power U_L feed-in (the supply of the Axioline F local bus U_{Bus} is generated from U_L)	
Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	typ. 97 mA (without I/O modules, U_L = 24 V) max. 600 mA (2.0 A at U_{Bus}, U_L = 24 V)
Surge protection	electronic
Reverse polarity protection	no

NOTE: Electronics may be damaged when overloaded

Provide external fuses for the 24 V U_L area. If you are using an external fuse, the power supply unit must be able to supply four times the nominal current of the fuse. This ensures that it trips in the event of an error.

Axioline F local bus supply (U_{Bus})	
Supply voltage	5 V DC (via bus base module)
Power supply unit	max. 2 A

Power dissipation	
Maximum power dissipation for nominal condition	4.4 W

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
PROFINET interface 1 / PROFINET interface 2	1500 V AC, 50 Hz, 1 min.
PROFINET interface 1 / 24 V communications voltage (U_L) feed-in	1500 V AC, 50 Hz, 1 min.
PROFINET interface 2 / 24 V communications voltage (U_L) feed-in	1500 V AC, 50 Hz, 1 min.
PROFINET interface 1 / functional ground	1500 V AC, 50 Hz, 1 min.
PROFINET interface 2 / functional ground	1500 V AC, 50 Hz, 1 min.
24 V communications voltage (U_L) feed-in / functional ground	500 V AC, 50 Hz, 1 min.

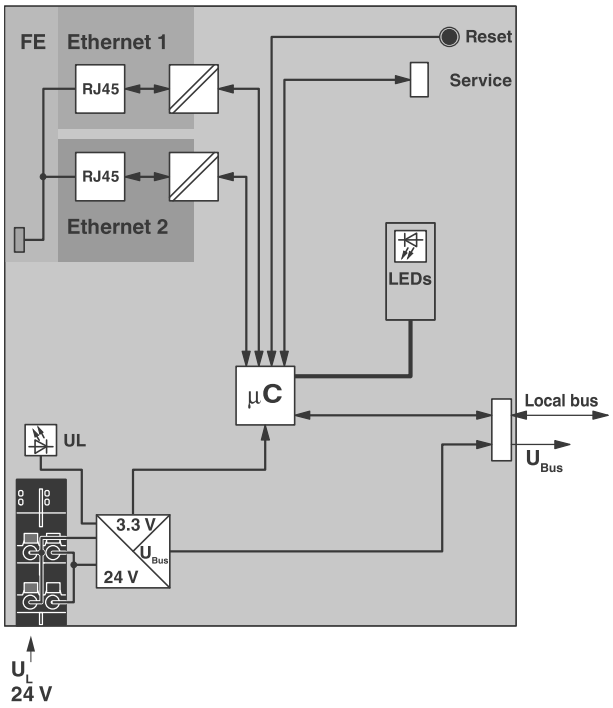
Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock in accordance with EN 60068-2-27/IEC 60068-2-27	10g

Conformance with EMC Directive 2014/30/EU	
Immunity test in accordance with EN IEC 61000-6-2	
Electrostatic discharge (ESD) IEC 61000-4-2	Criterion B, ±6 kV contact discharge, ±8 kV air discharge
Electromagnetic fields IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) IEC 61000-4-4	Criterion B, ±2 kV
Transient overvoltage (surge) IEC 61000-4-5	Criterion B; DC supply lines: ±0.5 kV/±1.0 kV (symmetrical/ asymmetrical), fieldbus cable shielding: ±1.0 kV
Conducted interference IEC 61000-4-6	Criterion A, Test voltage 10 V
Noise emission test in accordance with EN IEC 61000-6-3	Class B

Approvals and manufacturer's declarations	
The latest documents can be found at:	www.phoenixcontact.com/product/2403869

5 Internal circuit diagram

Figure 1 Internal wiring of the terminal points



Key:

FE	Functional ground
Ethernet 1/2	PROFINET 1/2
Reset	Reset button
Service	Service interface
Local bus	Axioline F local bus (hereinafter referred to as local bus)
RJ45	RJ45 interface
	Electrical isolation for data or power supply
	Power supply unit
µC	Microcontroller
	LED
	Electrically isolated areas

6 Security in the network

NOTE: Network security jeopardized by unauthorized access

Connecting devices to a network entails the danger of unauthorized access to the network.

Observe the following safety notes:

- If possible, deactivate unused communication channels.
- Use secure passwords reflecting the complexity and service life recommended in the latest guidelines.
- Only allow authorized persons to access the device. Limit the number of authorized persons to the necessary minimum.
- Always install the latest firmware version. The firmware can be downloaded via the item (www.phoenixcontact.com/products).
- Observe the IT security requirements and the standards applicable to your application. Take the necessary protective measures. These may include, for example, virtual networks for remote maintenance access or a firewall.
- In security-critical applications, always use the device with an additional security appliance. Phoenix Contact offers security appliances in the mGuard product range. The mGuard routers connect various networks for the remote maintenance and protection of the local network and protect these networks against cyberattacks.
- You must take defense-in-depth strategies into consideration when planning networks.

Additional measures for protection against unauthorized network access can be found in the “INDUSTRIAL SECURITY” application note. The application note can be downloaded via the item (www.phoenixcontact.com/products).
German: AH DE INDUSTRIAL SECURITY, 107913
English: AH EN INDUSTRIAL SECURITY, 107913

If a security vulnerability exists for products, solutions, or services from Phoenix Contact, it will be published on the PSIRT (Product Security Incident Response Team) website:
www.phoenixcontact.com/psirt

7 For your safety

7.1 Intended use

Use the Axioline F modules exclusively in accordance with the specifications in the accompanying data sheet and the “Axioline F: System and Installation” user manual.

If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

7.2 Qualification of users

The use of products described in this data sheet is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

7.3 Electrical safety

WARNING: loss of electrical safety

If used incorrectly, device safety may be impaired.

The instructions given in this data sheet as well as the UM EN AXL F SYS INST user manual must be observed during installation, startup, and operation.

7.4 Installation

Only install the Axioline F modules in a control cabinet or junction box.

CAUTION - Fire hazard

– The device must be installed in the final protective housing, which provides sufficient resistance to mechanical strain and protection against the spreading of fire in accordance with the standards UL/IEC/EN 61010-1 and UL/IEC/EN 61010-2-201.

– The supply and external circuits intended to be connected to this device shall be galvanically separated from the mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuits of UL/CSA/IEC/EN 61010-1, UL/CSA/IEC/EN 61010-2-201.

NOTE: damage to the contacts

Physical overloads can result in damage to the terminal points.

- Relieve strain in the connected cables.

7.5 Applications with UL approval

Information:

To install the device in accordance with UL/CSA/IEC standard, the following notes must be observed.

– Use copper conductors only.

– Minimum temperature rating of the cables to be connected to the field wiring terminals:

70 °C, AWG 24 ... 16

8 Connecting PROFINET and supply

8.1 Connecting PROFINET

Connect PROFINET to the bus coupler via an 8-pos. RJ45 connector.

Only one twisted pair cable with an impedance of 100 Ω may be connected to each Ethernet interface in RJ45 format. The data transmission speed is 100 Mbps. The 100Base-TX port of the bus coupler is able to detect a pair of incorrectly connected receive cables (RD+/RD-) and to correct them using the auto polarity correction function.

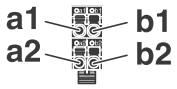
Auto crossover
Both Ethernet interfaces are provided with the auto crossover function.

Shielding
The shield of the connected twisted pair cables is electrically connected to the RJ45 socket. When connecting network segments, avoid ground loops, potential transfers, and equipotential bonding currents via the braided shield.

Observe bending radii
The housing dimensions specified under "Dimensions" refer to the bus coupler with I/O connectors without Ethernet connection. When installing the bus coupler in a control box, observe the bending radii of the Ethernet cables and the connectors used (e.g., FL CAT5 FLEX: 30 mm for fixed installation and FL CAT5 HEAVY: 30 mm without outer sheath and 45 mm with outer sheath). If required, use angled RJ45 connectors to maintain these bending radii.

8.2 Connecting the supply voltage

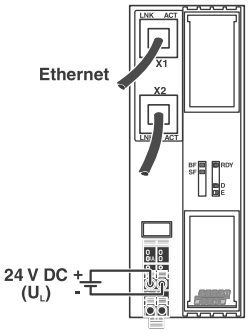
Figure 2 Terminal point assignment



Terminal point	Color	Assignment	
Supply voltage input			
a1, a2	Red	24 V DC (U_L)	Communications power feed-in (bridged internally)
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)

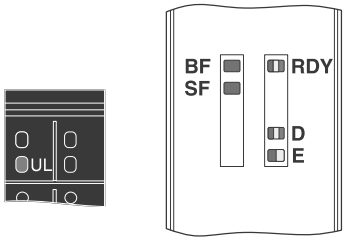
9 Connection example

Figure 3 Connection of the cables



10 Local diagnostic and status indicators

Figure 4 Local diagnostic and status indicators



Designation	Color	Meaning	State	Description
UL	Green	U_{Logic}	On	Communications power supply present.
			Off	Communications power supply not present.
BF	Red	Communication error (Bus Fault)	On	No link status available on any port
			Flashing	SF LED not flashing: Link status available, no communication connection to the PROFINET controller
			Flashing	SF flashing: Hardware watchdog triggered
			Off	A PROFINET controller has established an active communication connection to the PROFINET device.
SF	Red	System failure (PROFINET)	On	PROFINET diagnostics available
			Off	PROFINET diagnostics not available
			Flashing	Only flashes together with the BF LED. Watchdog has been triggered.
RDY	Green/ yellow/ red	Ready	Green on	Device is ready for operation.
			Flashing green/yellow	Communications power undervoltage or surge voltage
				Overtemperature
			Flashing green, LED D yellow on	Device is in standby mode.
			Yellow on	Firmware/bus coupler is booting
			Flashing yellow	Firmware update is being performed.
			Flashing yellow/red	Firmware update has failed. Check the firmware file and the settings.
			Red flashing	Faulty firmware
			Off	Device is not ready for operation.

Designation	Color	Meaning	State	Description
D	Red/ yellow/ green	Diagnostics of local bus communication		
		Run	Green on	The station is ready to operate; communication within the station is OK. All data is valid. An error has not occurred.
		Active	Flashing green	The station is ready to operate. Communication within the station is ok. The data are **not** valid. The controller or higher-level network is not providing valid data. The module is not malfunctioning.
			Flashing green/red	A rest system will be operated; at least one device of the configuration is not available.
		Ready	Yellow on	The station is ready to operate. No data are being exchanged.
			Flashing yellow	Access from Startup+ in I/O check mode
			Flashing yellow/red	Local bus error during active I/O check (with connected Startup+)
			Red flashing	Local bus error on startup
				Possible causes:
				The configuration cannot be generated. Information from one device is missing.
				Chip version of a device is <V1.1
				The desired and actual configuration are different
				No local bus device connected
				The maximum number of local bus devices is exceeded.
			Red on	The station is ready for operation but has lost connection to at least one device.
				Possible causes:
				Communication error
				Local bus device has been removed or configured device is missing.
				Reset at a local bus device
				Serious device error at a local bus device (local bus device can no longer be reached)
		Power down	Off	Device is in (power) reset or in energy-saving mode.
E	Yellow/ red	Error	Yellow on	I/O warning at a local bus device
			Red on	I/O error at a local bus device
			Off	No I/O messages present.

11 Diagnostic indicators for PROFINET

States during operation

LED	Meaning
SF OFF/BF OFF	PROFINET controller was able to establish communication without errors.

States in the event of an error

LED	Meaning	Measure/remedy in the event of an error
SF OFF/BF flashing	PROFINET device is waiting for communication with the PROFINET controller.	No error
	The logic communication connection has been interrupted. The PROFINET controller can no longer be accessed.	Check the connection between the PROFINET controller and the PROFINET device. Make sure that the PROFINET device name of the PROFINET device is identical with the configuration.
	The PROFINET device is not assigned a PROFINET device name.	Assign the PROFINET device name using the relevant tool.
SF OFF/BF ON	The physical communication path has been interrupted. The PROFINET controller can no longer be accessed.	Restore the physical connection between the PROFINET controller and the PROFINET device.
SF ON/BF OFF	Diagnostic data is available.	Read the diagnostic message using the relevant tool.
SF flashing/ BF flashing	Hardware watchdog has been triggered.	Execute a reset. Replace the device when the error occurs again.

States during firmware update

LED	Meaning
RDY flashing	BootP requests are sent and the firmware container is loaded via tftp.
RDY ON	Firmware is saved.

The firmware update can take several minutes.
The bus coupler is restarted automatically after a successful update.

12 Diagnostic status register

Information on the operating and error states of the Axioline F local bus is stored in the diagnostic status register of the bus coupler. A state of the Axioline F local bus is assigned to each bit in the diagnostic status register.

The states in the error bits (F_PW_BIT, F_PF_BIT, F_BUS_BIT, F_CTRL_BIT) are described in greater detail using the two diagnostic parameter registers. For information on this, please refer to the AXL F SYS DIAG user manual.

Structure of the diagnostic status register

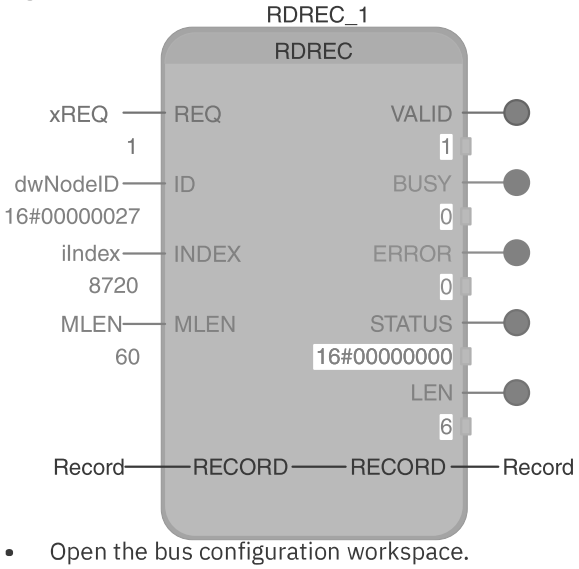
Bit	Designation	Meaning	
00	F_PW_BIT	I/O warning	At least one device indicates an I/O warning.
01	F_PF_BIT	I/O error	At least one device indicates a peripheral fault.
02	F_BUS_BIT	Bus error	A bus error has occurred.
03	-	Reserved	
04	-	Reserved	
05	F_RUN_BIT	Run	Data cycles are being exchanged, the output data is enabled.
06	F_ACTIVE_BIT	Active	Configuration is active, PDI to the devices is possible, data exchange with invalid/non-enabled process data.
07	F_READY_BIT	Ready	The local bus master is ready for operation, no data exchange over the bus.
08	F_BD_BIT	Bus different	A device which does not belong to the current configuration has been detected at the last interface.
09	F_BASP_BIT	SYS_FAIL	The controller is in the STOP state or no application program has been loaded. The output data is blocked (substitute value behavior is active).
10	F_FORCE_BIT	Force Mode	Force mode (startup tool/I/O check is active).
11	F_SYNC_BIT	Synchronization	Synchronization between higher-level system and local bus master has failed.
12	F_PARA_REQ	Module parameter	At least one device is requesting parameters.
13 ... 15	-	Reserved	

You can read the diagnostic status register using asynchronous services (index $2210_{hex} = 8720_{dec}$).

Example in PC Worx: sending a read service

The RDREC function block is available for sending read services.

Figure 5 RDREC function block



- Open the bus configuration workspace.
- In the “Bus Structure” window, select the bus coupler.
- In the “Device Details” window, select the “Module Settings” tab.
- Read off the bus coupler node ID (**decimal**).
- Enter the node ID **in hexadecimal form** on the input ID of the function block.

Please note:

PC Worx generates the node ID automatically. It may therefore vary in different projects.

The read service is sent with a rising edge at the REQ input of the function block. If the VALID output is TRUE, the response to the service is stored in the I/O variable RECORD.

The diagnostic status register is located in byte 0 and byte 1.

In the example, the following response is stored in variable RECORD:

Record	
[1]	16#00
[2]	16#E0
[3]	16#00
[4]	16#00
[5]	16#00
[6]	16#00
[7]	16#00
[8]	16#00
[9 ... 15]	16#00

In this example, the diagnostic status register has the value $00E0_{hex}$ ($0000\ 0000\ 1110\ 0000_{bin}$). Bits 5, 6, and 7 are TRUE. This means that data cycles are being exchanged, the configuration is active, and the local bus master is ready.

13 Diagnostic alarms

PROFINET enables the PROFINET device to store diagnostic information together with the error location and error type.

The alarms are enabled in the delivery state. However, you can disable the alarms on startup via parameters.

An incoming alarm informs the PROFINET controller that diagnostic information has been stored.

When the diagnostic information has been removed, an outgoing alarm is transmitted to the controller.

If at least one piece of diagnostic information is stored, the SF LED is on. If no diagnostic information is present, the SF LED is off.

14 Startup

Default upon delivery/default settings

The bus coupler is supplied with the following default settings:

PROFINET name:	No name assigned
IP parameters:	0.0.0.0
Module designation:	AXL F BK PN TPS
Vendor ID:	$00B0_{hex}$
Device ID:	1000_{hex}

Firmware started

Once you have supplied the bus coupler with power or pressed the reset button, the firmware is started. After completion of the firmware boot process the BF LED is either on or flashing.

Documentation

How to assign the PROFINET names and the IP address as well as how to startup a device within a PROFINET system is described in the following documents:

- "PC WORX" quick start guide
- "Configuring INTERBUS devices in a PROFINET network using the example of STEP 7" quick start guide

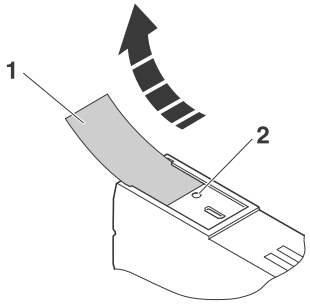
For the order designations, please refer to the ordering data.

The documentation can be found on the Internet at www.phoenixcontact.com/products.

15 Reset button

The reset button is located beneath the top marking label on the bus coupler.

Figure 6 Reset button



1 Marking field

2 Reset button

You can restart the bus coupler using the reset button.

Restart bus coupler

Restart the bus coupler by pressing the reset button during ongoing operation.

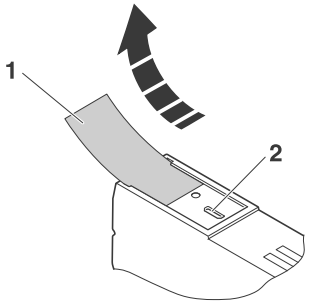
The outputs of the station are set to the parameterized substitute values.

The process image of the inputs is not re-read.

16 Service interface

The service interface is located beneath the top marking field on the bus coupler.

Figure 7 Service interface



1 Marking field

2 Service interface

Using the service interface via USB, you can connect the bus coupler to a PC on which Startup+, the startup and diagnostic tool, is running.

NOTE: Damage to the USB interface

In PCs, the USB ports are usually not electrically isolated from the rest of the hardware. This does not cause any problems for USB devices that do not have their own reference ground. However, if you connect grounded devices (e.g., the bus coupler), ground loops with undesired compensating currents may occur. These compensating currents can impair data transmission and, in extreme cases, destroy the interfaces.

Recommendation:

Connect the USB interface of the bus coupler to your PC in such a way that it is electrically isolated.
To do this, use a USB isolator.

Startup+

Startup+ offers the following functions:

- Parameterization of the station I/O modules
- I/O check
- Diagnostics

For detailed information on Startup+, please refer to the UM QS EN STARTUP+ user manual.

17 Parameterization

PC Worx

Parameterization of the PROFINET device in PC Worx requires at least PC Worx Version 6.30. This is part of the AUTOMATIONWORX Software Suite 1.80 and 1.81.

An online data sheet of the device with important technical data and a configuration file are integrated into PC Worx. If several versions of the configuration file are available, make sure that you are working with the file version that corresponds to the firmware/hardware version used.

Other tools

The PROFINET device is parameterized using the configuration tool of the PROFINET controller. Please integrate the corresponding GSDML file of the bus coupler into the relevant software tool (STEP 7/HW Config, ...).

Make sure you always use the latest version of the FDCML/GSDML file and the latest documentation for the bus coupler. The latest files and documentation can be found on the Internet at www.phoenixcontact.com/products.

18 Device replacement

You can replace devices in the PROFINET network, without having to reconfigure them. The station name and the station address are assigned by the controller to the newly added PROFINET bus coupler with the help of the neighborhood detection function.

19 PRL: Phoenix Redundancy Layer

The Phoenix Redundancy Layer (PRL) makes it possible to design a redundant system with two PROFINET controllers. One controller is configured as the primary I/O controller and the other as the backup I/O controller. Depending on which PROFINET controller provides valid values, the bus coupler operated at field level adopts these values or uses failsafe values.

If the PROFINET update time is ≥ 8 ms and the PROFINET watchdog time is > 200 ms, you can use PRL (or shared device) and MRP simultaneously.

20 Substitute value behavior

If Ethernet communication fails or an error occurs in the local bus, all outputs of the station are set to the substitute values previously parameterized on the module.

For the possible substitute values of a module, please refer to the relevant module-specific data sheet.

21 SNMP: Simple Network Management Protocol

The bus coupler supports SNMP v1 and v2c.

Management Information Base (MIB)

The corresponding latest MIBs are available on the Internet at www.phoenixcontact.com/products.

For the object descriptions, please refer to the ASN1 descriptions for this product.

The password for read access is “public”. This password cannot be changed.
By default, the password for write and read access is “private” in the delivery state. This password can be changed at any time.

22 WBM: Web-based management

The device has a web server, which generates the required pages for web-based management and, depending on the requirements of the user, sends them to a standard web browser.

You can use web-based management to access static or dynamic information. Examples of static information include technical data or the MAC address. Examples of dynamic information include IP addresses, status information, local bus structure and diagnostics.

Accessing web-based management

You can address the device's web server using the IP address if it is configured accordingly. The device's homepage (web page) is accessed by entering the URL http://<IP address>.
Example: http://172.16.113.38

The default password is "private".

If you cannot access the WBM pages, check the connection settings in your browser. Deactivate the proxy if set.

23 Firmware update

To update the bus coupler firmware, provide the bus coupler with a firmware container via a TFTP server or load it onto the bus coupler via FTP. You can use any FTP client or TFTP server for this, such as the PC Worx Firmware Updater.

For more detailed information regarding the firmware update, refer to the "Installation and operation of the PC Worx Firmware Updater software" user manual.

AXL SE DI16/1

Axioline Smart Elements, digital input module, digital inputs: 16, 24 V DC, connection technology: 1-conductor

Data sheet
108699_en_05

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1 Description

You can integrate Axioline Smart Elements into systems with the Smart Element interface.
This Smart Element detects digital signals.

Features

- 16 digital inputs in accordance with EN 61131-2 type 1 and type 3
- Nominal voltage: 24 V DC
- Nominal current: 2.4 mA
- Connection of sensors in 1-conductor technology
- Filter time of < 1 ms
- Device rating plate stored

Observe these notes

This data sheet is only valid in association with the UM EN AXL SE SYS INST user manual.

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.com/product/1088127

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3 Ordering data

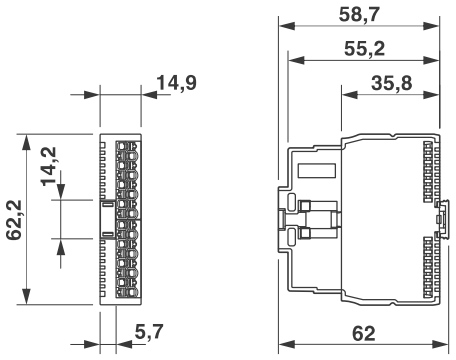
Description	Type	Item no.	Pcs./Pkt.
Axioline Smart Elements, Digital input module, Digital inputs: 16, 24 V DC, connection technology: 1-conductor, degree of protection: IP20	AXL SE DI16/1	1088127	1

Documentation	Type	Item no.	Pcs./Pkt.
User manual, English, Axioline Smart Elements	UM EN AXL SE SYS INST	-	-
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-

Additional ordering data	
For additional ordering data (accessories), go to:	www.phoenixcontact.com/product/1088127

4 Technical data

Dimensions (nominal sizes in mm)



Width	14.9 mm
Height	62.2 mm
Depth	62 mm

General data	
Color	Housing: traffic grey A (RAL 7042)
Weight	35 g
Ambient temperature (operation)	-25 °C … 60 °C
Ambient temperature (storage/transport)	-40 °C … 85 °C
Permissible humidity (operation)	5 % … 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % … 95 % (non-condensing)
Air pressure (operation)	70 kPa … 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa … 106 kPa (up to 3000 m above sea level)

General data	
Degree of protection	IP20
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Overvoltage category	II (IEC 60664-1, EN 60664-1)
Degree of pollution	2 (IEC 60664-1, EN 60664-1)
Mounting type	Plug-in mounting (Smart Element slot)
Mounting position	See the system in which the Smart Element is used.

Do not use the Smart Element in an atmosphere that contains corrosive gas.

Connection data: I/O	
Connection method	Push-in connection
Conductor cross-section, rigid	0.25 mm² ... 1.5 mm²
Conductor cross-section, flexible	0.25 mm² ... 1.5 mm²
Conductor cross-section [AWG]	24 ... 16
Conductor cross-section flexible, with ferrule with plastic sleeve	0.25 mm² ... 1.5 mm²
Conductor cross-section flexible, with ferrule without plastic sleeve	0.25 mm² ... 1.5 mm²
Stripping length	8 mm

Please observe the information provided on conductor cross-sections in the “Axioline Smart Elements” user manual.

Interface: Smart Element interface	
Number of interfaces	1
Connection method	Card edge connector
Start time until ready to operate	< 500 ms

Communications power supply of the Smart Elements (U_{SE})	
Supply voltage	using card edge connectors
Current draw	See documentation for the system in which the Smart Element is used.

I/O supply (U_P)	
Nominal supply voltage	24 V DC (using card edge connectors)
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	min. 14 mA (without connected peripherals) max. 17 mA
Surge protection	See the system in which the Smart Element is used.
Reverse polarity protection	Polarity protection diode
Protection	See the system in which the Smart Element is used.

Power dissipation	
Maximum power dissipation for nominal condition	1.4 W

Digital inputs	
Number of inputs	16
Connection method	Push-in connection
Connection technology	1-conductor
Description of the input	EN 61131-2 types 1 and 3
Nominal input voltage	24 V DC
Nominal input current	2.4 mA
Current flow	linear until nominal current is reached, then constantly approx. 2.4 mA
Input voltage range "0" signal	-3 V DC ... 5 V DC
Input voltage range "1" signal	11 V DC ... 30 V DC
Input filter time	< 1 ms
Process data update	typ. 340 µs
Polarity reversal protection of the inputs	Diode

Input and output address area	
Input address area	2 Byte
Output address area	0 Byte

Configuration and parameter data in a PROFIBUS system	
Required parameter data	1 Byte
Required configuration data	6 Byte

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
Communications supply / 24 V supply (I/O)	500 V AC, 50 Hz, 1 min
Communications supply / functional ground	500 V AC, 50 Hz, 1 min
24 V supply (I/O) / functional ground	500 V AC, 50 Hz, 1 min

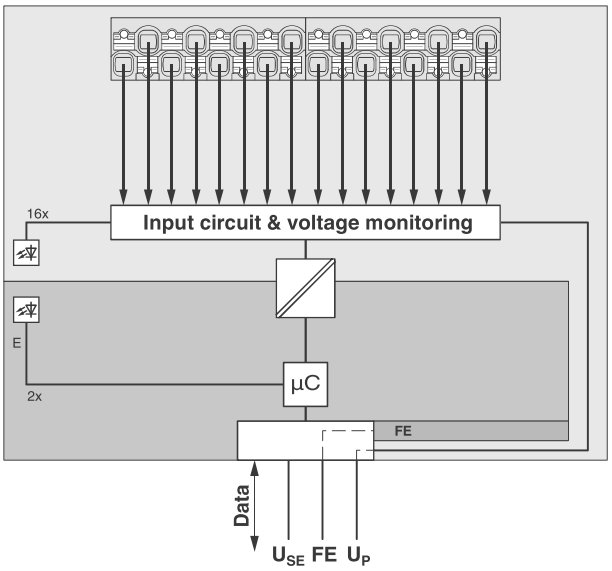
Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock in accordance with EN 60068-2-27/IEC 60068-2-27	10g

Conformance with EMC Directive 2014/30/EU	
Immunity test in accordance with EN IEC 61000-6-2	
Electrostatic discharge (ESD) IEC 61000-4-2	Criterion B, ±6 kV contact discharge, ±8 kV air discharge
Electromagnetic fields IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) IEC 61000-4-4	Criterion B, ±2 kV
Transient overvoltage (surge) IEC 61000-4-5	Criterion B, I/O cables: ±1 kV asymmetrical
Conducted interference IEC 61000-4-6	Criterion A, Test voltage 10 V
Noise emission test in accordance with EN IEC 61000-6-4	Class A

Approvals and manufacturer's declarations	
The latest documents can be found at:	www.phoenixcontact.com/product/1088127

5 Internal circuit diagram

Figure 1 Internal wiring of the terminal points



Key:

Data	Data transmission
U_{SE}	Communications power supply of the Smart Element
FE	Functional ground
U_P	I/O supply of the Smart Element
µC	Microcontroller
	Electrical isolation for data or power supply
	LED
Input circuit ...	Input circuit and voltage monitoring
	Electrically isolated areas

6 For your safety

6.1 Intended use

Use Smart Elements exclusively in accordance with the specifications in the data sheet and the “Axioline Smart Elements” user manual.
Please also refer to the documentation for the system in which the Smart Elements are used.

If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

6.2 Qualification of users

The use of products described in this data sheet is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

6.3 Installation

CAUTION: Fire hazard

- The device must be installed in the final protective housing, which provides sufficient resistance to mechanical strain and protection against the spreading of fire in accordance with the standards UL/IEC/EN 61010-1 and UL/IEC/EN 61010-2-201.
- The external circuits intended to be connected to this device must be galvanically separated from mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuits in accordance with UL/CSA/IEC/EN 61010-1, UL/CSA/IEC/EN 61010-2-201.

6.4 Disconnecting or plugging in a Smart Element

NOTE: Damage to contacts or malfunction

Before performing work on a Smart Element, disconnect the power to the Smart Element.

This means:

- Disconnect the connected I/O devices from the power.
- Switch off the I/O supply voltage U_P!
- Switch off the communications power U_{SE}. For the system in which the Smart Element is used, this means the following: Switch off the voltage that generates the U_{SE}.

6.5 Strain relief

NOTE: Damage to the contacts

Physical overloads can result in damage to the terminal points.

- Relieve strain in the connected cables.

6.6 Locking a Smart Element

Make sure that each Smart Element is locked in its slot. This is only ensured if the unlocking mechanism has been pushed into the guide as far as it will go.

See “Axioline Smart Elements” user manual.

6.7 Using round cables CABLE-FLK14/AXIO/OE/0,14/...

For this Smart Element, the use of assembled round cables CABLE-FLK14/AXIO/OE/0,14/... is permitted. The conductors of these cables are fitted with ferrules and have a conductor cross-section of 0.14 mm², AWG 26.

UL approval does not apply

For applications with UL approvals, the AWG 24-16 conductor cross-section is certified.

Due to the smaller conductor cross-section of AWG 26, **UL approval** does **not** apply when using the Smart Element in combination with a round cable.

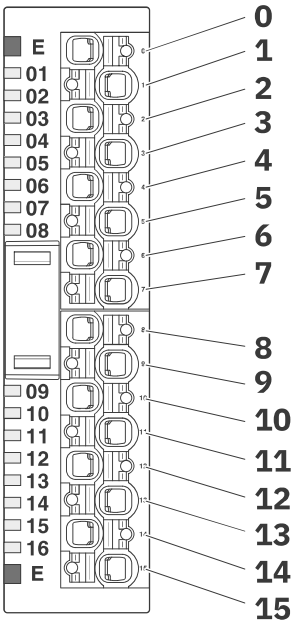
6.8 Applications with UL approval

Information:
To install the device in accordance with UL/CSA/IEC standard, the following notes must be observed.

- Minimum temperature rating of the cables to be connected to the field wiring terminals:
  105 °C, AWG 24 ... 16
- Use copper conductors only.

7 Terminal point assignment as well as diagnostics and status indicators

Figure 2 Terminal point assignment as well as diagnostics and status indicators



7.1 Terminal point assignment

Terminal point	Assignment	Channel	Signal
0	Digital input	1	IN01
...	...	...	...
15	Digital input	16	IN16

7.2 Local diagnostics and status indicators

Designation	Color	Description	
E	Red	Error	
		Off	No error
		Flashing (0.5 Hz)	Error in Smart Element Replace the Smart Element.
		Flashing (4 Hz)	Communication error Check whether the Smart Element has been plugged in correctly.
		On	I/O error Check the connected components and wiring. Remove the error.
01 ... 16	Yellow	Status of the input	
		On	Input is set.
		Off	Input is not set.

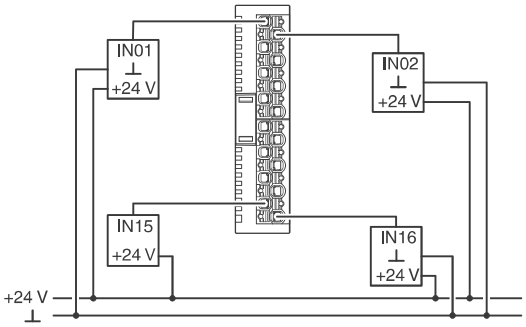
See also “Diagnostic state (0018_{hex}: DiagState)” section, “Possible error codes” table.

8 Connection examples

Ensure that GND of the sensors and actuators and GND for the I/O supply voltage U_P have the same potential.

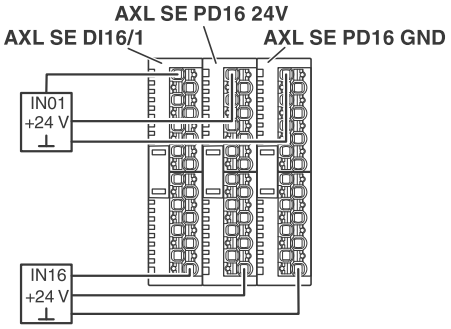
8.1 Using equipotential busbars

Figure 3 Connection in 1-conductor technology



8.2 Using AXL SE PD ...

Figure 4 Connection in 3-conductor technology



To implement the connections of this Smart Element in multi-conductor technology on Smart Elements, you can use the following Smart Elements for potential distribution:

Item No.	Type	Features
1337223	AXL SE PD16 24V	16 x 24 V (U_P)
		2 electronic switches, 2 A each
1337224	AXL SE PD16 GND	16 x GND (U_P)
1337225	AXL SE PD8/8 24V/ GND	8 x 24 V (U_P)
		8 x GND (U_P)
		1 electronic switch, 4 A

Detailed information on the Smart Elements for potential distribution can be found in the associated data sheets. There you will also find instructions for use and examples.

9 Process data

The process data is mapped in Motorola format (Big Endian).

Byte	0							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Signal	IN08	IN07	IN06	IN05	IN04	IN03	IN02	IN01
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Signal	IN16	IN15	IN14	IN13	IN12	IN11	IN10	IN09
Terminal point	15	14	13	12	11	10	9	8

10 Parameter, diagnostics and information (PDI)

10.1 PDI objects

The module has PDI objects. They are used to map parameters, diagnostic data, and information about the module. The PDI objects can be read and/or written acyclically.

You can find out how to access the PDI objects in the documentation for the bus coupler or the controller used.

The PDI objects necessary for operation are described in the following section.

You will find an explanation of the data types in the user manual UM EN AXL F SYS INST.

The following applies to all tables below:

Abbreviation	Meaning
Length in bytes	Maximum length of the elements in bytes
R	Read
W	Write
[x]	Number of elements in an array or record

Each visible string is terminated with a null terminator (00_{hex}). The length of a visible-string-type element is therefore at least one byte larger than the number of user data items.
If the number of user data items plus null terminator is smaller than the specified length of the element, the visible string will be populated with a null character (00_{hex}).

You will find detailed information on the PDI objects in the user manual UM EN AXL F SYS INST.

10.2 Retentive storage

Axioline Smart Elements can have retentively (non-volatilely) and volatilely stored parameters.

Retentively stored parameters retain their values even after the module voltage is reset.

For writeable parameters, the following tables indicate whether they are stored retentively or volatilely.

A write operation to the module memory is only triggered if the value of at least one retentive parameter has been changed.

Due to the storage technology used, parameters that are stored retentively only allow a certain number of write access operations (typ. 100,000 to 1,000,000 times). **They are not suitable for being changed cyclically.**

NOTE: Damage to the Flash memory during cyclic write access

The flash memory is only designed for a limited number of write access operations.

- Make sure that write access operations are not performed too often and, in particular, are not performed cyclically.
- Note this behavior when programming function blocks.
- For systems with initial parameterization (e.g., PROFINET), avoid parameterization from the application program.

11 Standard objects

Index (hex)	Object name	Data type	Length in bytes	Rights	Meaning/contents		Retentive storage	
Device type								
0037	DeviceType	Octet string	8	R	Device type	0080 0002 0000 1D18$_{hex}$		
Diagnostics objects								
0018	DiagState	Record [11]	74	R	Diagnostic state			*
0019	ResetDiag	UINT8	1	R/W	Handling diagnostic messages		No	*
Objects for process data management								
0025	PDIN	Octet string	2	R	Input process data The structure corresponds to the representation in the "Process data" section.			
0026	PDOUT	Octet string	2	R	Output process data is not available			

The objects identified with * in the last column are described in more detail in the following sections.

The description of the other objects is to be found in the user manual UM EN AXL F SYS INST.

11.1 Diagnostics state (0018_{hex}: DiagState)

This object is used for a structured message of an error.

Read off all information via subindex 00 to receive all information on an error number. Access to individual elements of the object is not permitted.

A detailed description of the object is provided in user manual UM EN AXL F SYS INST.

Possible error codes

Element	02	03	04	08	0B		
Error	Priority	Channel	Error code	Function group	Text	E LED	Corrective
	hex	hex	hex				
No error	00	00	0000	General	Status OK	○	
I/O supply voltage (U_P) is not present.	01	FF	3130	General	Supply missing (U_P)	●	Check the supply voltage.
Error in the Smart Element firmware	01	FF	6100	General	Firmware error, update required	●	Replace the Smart Element.
Problem communicating with the Smart Element	01	FF	6130	General	Smart Element missing	✹	Check whether the Smart Element has been plugged in correctly. If the error is still present, replace the Smart Element.
Error in the parameter memory	01	FF	6320	General	Parameter error, repeat parameterization	●	Error in the parameter memory. Parameterize the Smart Element.

Key

Priority	00_{hex}	No error
	01_{hex}	Error
Channel	00_{hex}	No error
	FF_{hex}	Entire device

LED	○	Off
	●	On
	✹	Flashing (4 Hz)

11.2 Handling diagnostic messages (0019_{hex}: ResetDiag)

You can use this object to specify how the Smart Element should handle diagnostic messages.

Handling diagnostic messages	
Value (hex)	**Meaning**
00	**Permit all diagnostic messages (default)**
02	Delete all diagnostic messages that are still pending
06	Delete all diagnostic messages and do not permit new ones
Other	Reserved

12 Device descriptions

The device is described in the device description files. The device descriptions for controllers from Phoenix Contact are included in PC Worx and PLCnext Engineer, as well as in the corresponding service packs.

The device description files for other systems are available for download in the download area of the installed bus coupler at the following address: www.phoenixcontact.com/products.

AXL SE DO16/1

Axioline Smart Elements, digital output module, digital outputs: 16, 24 V DC, 500 mA, connection technology: 1-conductor

Data sheet
108700_en_04

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1 Description

You can integrate Axioline Smart Elements into systems with the Smart Element interface.
This Smart Element emits digital signals.

Features

- 16 digital outputs
- 24 V DC, 500 mA
- Connection of actuators in 1-conductor technology
- Substitute value behavior of the outputs can be parameterized for the Smart Element
- Device rating plate stored

This data sheet is only valid in association with the UM EN AXL SE SYS INST user manual.

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.net/product/1088129

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3 Ordering data

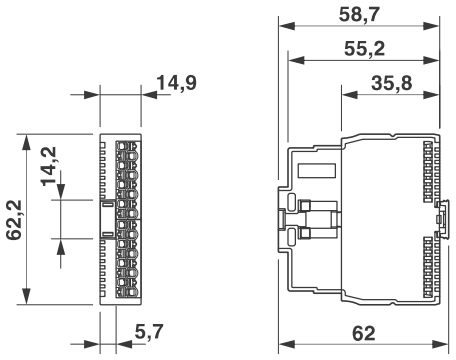
Description	Type	Item no.	Pcs./Pkt.
Axioline Smart Elements, Digital output module, Digital outputs: 16, 24 V DC, 500 mA, connection technology: 1-conductor, degree of protection: IP20	AXL SE DO16/1	1088129	1

Documentation	Type	Item no.	Pcs./Pkt.
User manual, English, Axioline Smart Elements	UM EN AXL SE SYS INST	-	-
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-

Additional ordering data	
For additional ordering data (accessories), go to:	www.phoenixcontact.net/product/1088129

4 Technical data

Dimensions (nominal sizes in mm)



Width	14.9 mm
Height	62.2 mm
Depth	62 mm

General data	
Color	traffic grey A RAL 7042
Weight	37 g
Ambient temperature (operation)	-25 °C ... 60 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)

General data	
Degree of protection	IP20
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Overvoltage category	II (IEC 60664-1, EN 60664-1)
Degree of pollution	2 (IEC 60664-1, EN 60664-1)
Mounting type	Smart Element slot
Mounting position	See the system in which the Smart Element is used.

Do not use the Smart Element in an atmosphere that contains corrosive gas.

Connection data: I/O	
Connection method	Push-in connection
Conductor cross section, rigid	0.25 mm² ... 1.5 mm²
Conductor cross section, flexible	0.25 mm² ... 1.5 mm²
Conductor cross section [AWG]	24 ... 16
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm² ... 1.5 mm²
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm² ... 1.5 mm²
Stripping length	8 mm

Please observe the information provided on conductor cross sections in the “Axioline Smart Elements” user manual.

With a small conductor cross section and high current, the terminal point temperature can reach up to 45 K above the ambient temperature.

When selecting the cables, observe the permissible operating temperature in accordance with IEC or UL.

Interface: Smart Element interface	
Number of interfaces	1
Connection method	Card edge connector
Start time until ready to operate	< 500 ms

Communications power supply of the Smart Elements (U_{SE})	
Supply voltage	using card edge connectors
Current draw	See documentation for the system in which the Smart Element is used.

I/O supply (U_P)	
Nominal supply voltage	24 V DC (using card edge connectors)
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	min. 40 mA (without connected peripherals) max. 6 A
Power consumption	min. 288 mW max. 180 W (of which 1.1 W internal losses)
Surge protection	See the system in which the Smart Element is used.
Reverse polarity protection	parallel diode

I/O supply (U_P)	
Protection	See the system in which the Smart Element is used.

NOTE: Damage to the electronics

To ensure reverse polarity protection, provide external protection for the Smart Element in the system that you are using it in. If you use a fuse, the power supply unit must be capable of supplying four times the nominal current of the fuse. This ensures that the fuse trips reliably in the event of a fault.

When starting up the Smart Element for the first time in the system that you have installed it, protect the system with a 5 A fuse. When all Smart Elements in the system are correctly connected, the 5 A fuse can be replaced with a fuse as specified for the system that you have installed the Smart Element in.

After that, you can load the Smart Element by up to 6 A. Loads over 6 A are not permitted.

Digital outputs	
Number of outputs	16
Connection method	Push-in connection
Connection technology	1-conductor
Nominal output voltage	24 V DC
Output current per channel	max. 500 mA
Output current of the device	6 A (Also make sure that the maximum permissible current of 6 A is not exceeded.)
Nominal load, ohmic	12 W (48 Ω, with nominal voltage)
Nominal load, inductive	12 VA (1.2 H, 48 Ω, with nominal voltage)
Nominal load, lamp	12 W (at nominal voltage)
Load min.	10 kΩ
Energy consumption	see diagram
Limitation of the voltage induced on circuit interruption	-32.8 V DC ... -15 V DC
Output voltage when switched off	max. 1 V
Output current when switched off	max. 300 µA
Signal delay	max. 100 µs (when switched on) max. 100 µs (when switched off, with at least 50 mA load current)
Switching frequency	max. 1200 per second (With resistive load, at least 50 mA load current) max. 1 per second (with inductive load) max. 16 per second (with nominal lamp load)

The specified switching frequency is limited by the device hardware. The switching frequency that can actually be achieved depends on the update time of the overall system, including the cycle times of the controller, network, etc.

Short-circuit and overload protection	electronic
Behavior with overload	Shutdown with automatic restart
Behavior with inductive overload	Output can be destroyed
Reverse voltage resistance to short pulses	limited protection up to 0.5 A for 1 s

NOTE: Damage to the electronics

In the event of an incorrectly applied external voltage (reverse voltage) at one of the outputs, the channel that has been exposed to the reverse voltage can be destroyed and further outputs may unintentionally be set.

Digital outputs	
Overcurrent shut-down	min. 0.7 A
Output current with ground connection interrupt when switched off	< 1 mA
Process data update	typ. 370 µs

Input and output address area	
Input address area	0 Byte
Output address area	2 Byte

Configuration and parameter data in a PROFIBUS system	
Required parameter data	9 Byte
Required configuration data	6 Byte

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
Communications supply / 24 V supply (I/O)	500 V AC, 50 Hz, 1 min.
Communications supply / functional ground	500 V AC, 50 Hz, 1 min.
24 V supply (I/O) / functional ground	500 V AC, 50 Hz, 1 min.

Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock in accordance with EN 60068-2-27/IEC 60068-2-27	10g

Conformance with EMC Directive 2014/30/EU	
Immunity test in accordance with EN 61000-6-2/IEC 61000-6-2	
Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2	Criterion B, 6 kV contact discharge, 8 kV air discharge
Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) EN 61000-4-4/IEC 61000-4-4	Criterion B, 2 kV
Transient overvoltage (surge) EN 61000-4-5/IEC 61000-4-5	Criterion B, I/O cables: ±1 kV asymmetrical
Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A, Test voltage 10 V
Noise emission test in accordance with EN 61000-6-4/IEC 61000-6-4	Class A

Approvals	
For the current approvals, go to:	www.phoenixcontact.net/product/1088129

Manufacturer's declarations	
For the current manufacturer’s declarations, go to:	www.phoenixcontact.net/product/1088129

5 Maximum outputs power consumption when inductive loads are switched off

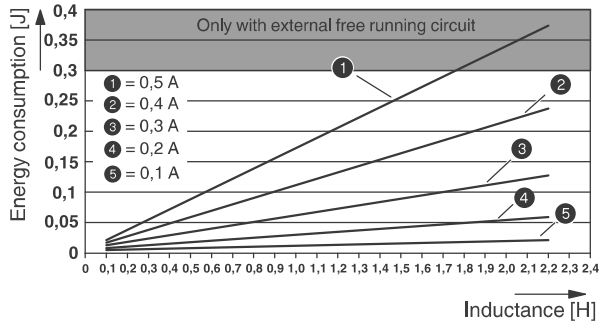
NOTE: Damage to the electronics

When you use an external freewheel limit, the freewheeling voltage to a maximum of -15 V.

The value **must** be above -15 V, so -12 V, for example.

The external freewheel limit has no function with a higher negative voltage.

Figure 1 Maximum outputs power consumption when inductive loads are switched off



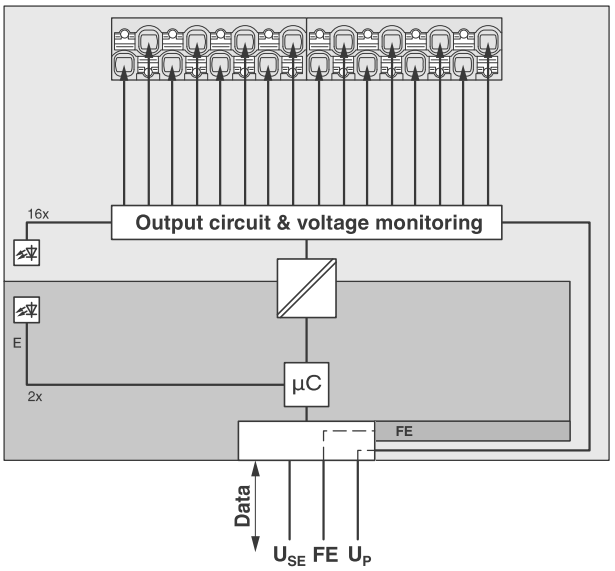
The specifications in the diagram refer to a maximum switching frequency of 1 Hz.

The diagram shows the maximum amount of energy that may be fed back into the corresponding output groups (outputs 1 to 8, 9 to 16) for each switch-off procedure when switching off an inductive load without external freewheeling circuit.

The current data refers to the ohmic DC voltage component of the inductive load.

6 Internal circuit diagram

Figure 2 Internal wiring of the terminal points



Key:

Data	Data transmission
U_{SE}	Communications power supply of the Smart Element
FE	Functional ground
U_P	I/O supply of the Smart Element
µC	Microcontroller
	Electrical isolation for data or power supply
	LED
Output circuit ...	Output circuit and voltage monitoring
	Electrically isolated areas

7 For your safety

7.1 Intended use

Use Smart Elements exclusively in accordance with the specifications in the data sheet and the “Axioline Smart Elements” user manual.
Please also refer to the documentation for the system in which the Smart Elements are used.

If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

7.2 Qualification of users

The use of products described in this data sheet is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

7.3 Electrical safety

WARNING: loss of electrical safety

The external circuits intended to be connected to this device shall be galvanically separated from the mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuits of UL/CSA/IEC/EN 61010-1, UL/CSA/IEC/ EN 61010-2-201.

7.4 Disconnecting or plugging in a Smart Element

NOTE: Damage to contacts or malfunction

Before performing work on a Smart Element, disconnect the power to the Smart Element.

This means:

- Disconnect the connected I/O devices from the power.
- Switch off the I/O supply voltage U_P!
- Switch off the communications power U_{SE}. For the system in which the Smart Element is used, this means the following: Switch off the voltage that generates the U_{SE}.

7.5 Strain relief

NOTE: damage to the contacts

Physical overloads can result in damage to the terminal points.

- Relieve strain in the connected cables.

7.6 Locking a Smart Element

Make sure that each Smart Element is locked in its slot. This is only ensured if the unlocking mechanism has been pushed into the guide as far as it will go.

See “Axioline Smart Elements” user manual.

7.7 Using round cables CABLE-FLK14/AXIO/OE/0,14/...

For this Smart Element, the use of assembled round cables CABLE-FLK14/AXIO/OE/0,14/... is permitted. The conductors of these cables are fitted with ferrules and have a conductor cross-section of 0.14 mm², AWG 26.

UL approval not required

For applications with UL approvals, the AWG 24-16 conductor cross-section is certified.

Due to the smaller conductor cross-section of AWG 26, **UL approval** is **not** required when using the Smart Element in combination with a round cable.

7.8 Applications with UL approval

CAUTION: Fire hazard

The device has to be installed in the final safety enclosure, which has adequate rigidity according to UL 61010-1, UL 61010-2-201 and meets the requirements with respect to spread of fire.

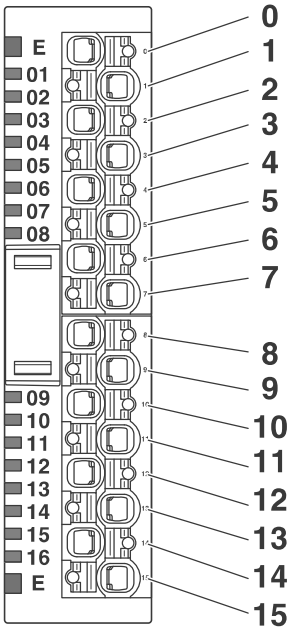
Information:

To install the device in accordance with UL/CSA/ IEC standard, the following notes must be observed.

– Minimum temperature rating of the cables to be connected to the field wiring terminals:
  105 °C, AWG 24 ... 16
– Use copper conductors only.

8 Terminal point assignment as well as diagnostics and status indicators

Figure 3 Terminal point assignment as well as diagnostics and status indicators



8.1 Terminal point assignment

Terminal point	Assignment	Channel	Signal
0	Digital output	1	OUT01
...	...	...	...
15	Digital output	16	OUT16

8.2 Local diagnostics and status indicators

Designation	Color	Description	
E	Red	Error	
		Off	No error
		Flashing (0.5 Hz)	Error in Smart Element Replace the Smart Element.
		Flashing (4 Hz)	Communication error Check whether the Smart Element has been plugged in correctly.
		On	I/O error Check the connected components and wiring. Remove the error.
01 ... 16	Yellow	Output status	
		On	Output is set.
		Off	Output is not set.

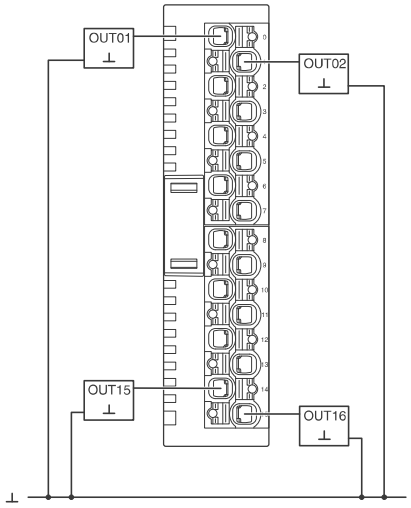
See also “Diagnostic state (0018_{hex}: DiagState)” section, “Possible error codes” table.

9 Connection examples

Make sure that the GND of the actuators and the GND for U_P have the same potential!

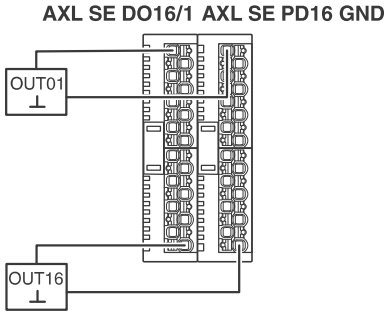
9.1 Using equipotential busbars

Figure 4 Connection in 1-conductor technology



9.2 Using AXL SE PD ...

Figure 5 Connection in 2-conductor technology



To implement the connections of this Smart Element in multi-conductor technology on Smart Elements, you can use the following Smart Elements for potential distribution:

Item No.	Type	Features
1337224	AXL SE PD16 GND	16 x GND (U_P)
1337225	AXL SE PD8/8 24V/ GND	8 x 24 V (U_P)
		8 x GND (U_P)
		1 fuse, 4 A

Detailed information on the Smart Elements for potential distribution can be found in the associated data sheets. There you will also find instructions for use and examples.

10 Process data

The process data is mapped in Motorola format (Big Endian).

Byte	0							
Bit	7	6	5	4	3	2	1	0
Signal	OUT 08	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Signal	OUT 16	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09
Terminal point	15	14	13	12	11	10	9	8

11 Parameter, diagnostics and information (PDI)

Parameter and diagnostic data as well as other information are transmitted as objects via the PDI channel.

For more detailed information on all possible standard objects for Axioline Smart Elements, please refer to the UM EN AXL SE SYS INST user manual.

The standard objects necessary for operation are described in the following section.

The following applies for the tables below:

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read
W	Write

12 Standard objects

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents		Startup parameters	
Device type									
0037	DeviceType	Octet string	1	8	R	Device type	0040 0002 0000 1D19$_{hex}$	No	
Diagnostics objects									
0018	DiagState	Record	11	74	R	Diagnostic state		No	*
0019	ResetDiag	UINT8	1	1	R/W	Handling diagnostic messages		No	*
Objects for process data management									
0024	ResetCode	UINT16	1	2	R/W	Substitute value behavior during bus reset (PDOUT)		Yes	*
0025	PDIN	Octet string	1	2	R	Input process data is not available.		No	
0026	PDOUT	Octet string	1	2	R	OUT process data The structure corresponds to the representation in the “Process data” section.		No	
Objects for device management									
002D	ResetParam	UINT8	1	1	R/W	Reset parameterization		No	*

Startup parameters are stored permanently in the Flash memory.

The objects identified with * in the last column are described in more detail in the following sections.

The description of the other objects is to be found in the user manual UM EN AXL F SYS INST.

12.1 Diagnostics state (0018_{hex}: DiagState)

This object is used for a structured message of an error.

A detailed description of the object is provided in user manual UM EN AXL F SYS INST.

Possible error codes

Subindex	02	03	04	08	0B		
Error	Priority	Channel	Error code	Function group	Text	E LED	Corrective
	hex	hex	hex				
No error	00	00	0000	General	Status OK	○	
Overload or short circuit of an output	01	FF	2344	DO	Overload or short circuit (output)	●	Check the connected components and wiring.
I/O supply voltage (U_P) is not present.	01	FF	3130	General	Supply missing (U_P)	●	Check the supply voltage.
Error in the Smart Element firmware	01	FF	6100	General	Firmware error, update required	●	Replace the Smart Element.
Problem communicating with the Smart Element	01	FF	6130	General	Smart Element missing	✹	Check whether the Smart Element has been plugged in correctly. If the error is still present, replace the Smart Element.
Error in the parameter memory	01	FF	6320	General	Parameter error, repeat parameterization	●	Error in the parameter memory. Parameterize the Smart Element.

Key

Priority	00_{hex}	No error
	01_{hex}	Error
Channel	00_{hex}	No error
	FF_{hex}	Entire device

LED	○	Off
	●	On
	✹	Flashing (4 Hz)

12.2 Handling diagnostic messages (0019_{hex}: ResetDiag)

You can use this object to specify how the Smart Element should handle diagnostic messages.

Handling diagnostic messages	
Value (hex)	**Meaning**
00	Permit all diagnostic messages
02	Delete and acknowledge all diagnostic messages that are still pending
06	Delete and acknowledge all diagnostic messages and do not permit new diagnostic messages
Other	Reserved

12.3 Substitute value behavior during bus reset (PDOUT) (0024_{hex}: ResetCode)

Use this object to parameterize the behavior of the Smart Element outputs in the event that process data is missing.

0024_{hex}: substitute value behavior during bus reset (PDOUT) (read, write)			
Subindex (hex)	**Data type**	**Length in bytes**	**Meaning/contents**
00	UINT16	2	Read or write entire object.
			Substitute value behavior of the outputs

Value range	
Value (hex)	**Meaning**
0000	**0 is output to all output bits (default)**
0001	1 is output to all output bits
0002	Hold last value
Other	Reserved

12.4 Reset parameterization ($002D_{hex}$: ResetParam)

Use this object to reset certain parameters to the factory default settings (default values).

To reset the parameters, value 01_{hex} must be transferred during write access.

Reset the following parameters using this object:

Index (hex)	Object name	Meaning
0024	ResetCode	Substitute value behavior during bus reset (PDOUT)

13 Device descriptions

The device is described in the device description files.
The device descriptions for controllers from Phoenix Contact are included in PC Worx and PLCnext Engineer, as well as in the corresponding service packs.
The device description files for other systems are available for download at www.phoenixcontact.net/products in the download area of the bus coupler installed.

AXL SE SC-A

Axioline Smart Elements, slot cover with diagnostic function

Data sheet
108990_en_03

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1 Description

You can integrate Axioline Smart Elements into systems with the Smart Element interface.
This Smart Element covers an unused Smart Element slot.

Features

- Protects an unused Smart Element slot
- Device rating plate stored

If you are using an engineering system and an AXL SE SC-A slot cover, plan the Smart Element accordingly.

Note when using bus couplers for PROFIBUS DP with the hardware and software (HW/SW) firmware version it runs:

AXL F BK PB: HW/FW ≤ 05/2.13
AXL F BK PB XC: HW/FW ≤ 00/2.13

The bus coupler does not support AXL SE SC-A slot covers.

Use another Smart element to cover the unused slots, such as AXL SE DI16/1.

This data sheet is only valid in association with the UM EN AXL SE SYS INST user manual.

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.net/product/1088134

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2 Table of contents 2
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3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Axioline Smart Elements, Slot cover, Diagnostic function, degree of protection: IP20	AXL SE SC-A	1088134	1

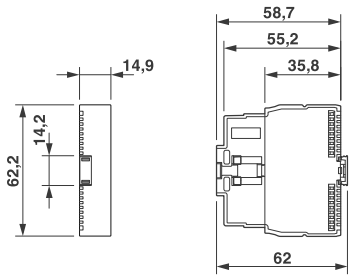
Documentation	Type	Order No.	Pcs./Pkt.
User manual, English, Axioline Smart Elements	UM EN AXL SE SYS INST	-	-

Additional ordering data

For additional ordering data (accessories), please refer to user manual UM EN AXL SE SYS INST or go to phoenixcontact.net/products.

4 Technical data

Dimensions (nominal sizes in mm)



Width	14.9 mm
Height	62.2 mm
Depth	62 mm

General data	
Color	traffic grey A RAL 7042
Weight	28 g
Ambient temperature (operation)	-25 °C ... 60 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Overvoltage category	II (IEC 60664-1)

General data	
Degree of pollution	2 (EN 60664-1)
Mounting position	See the system in which the Smart Element is used.
Do not use the Smart Element in an atmosphere that contains corrosive gas.	

Connection data	
Connection method	without

Interface: Smart Element interface	
Number	1
Connection method	Card edge connector
Start time until ready to operate	< 500 ms (after switching on the supply voltage (object $003D_{hex}$: WakeUpTime))

Communications power supply of the Smart Elements (U_{SE})	
Supply voltage	using card edge connectors
Current draw	See documentation for the system in which the Smart Element is used.

Input and output address area	
Input address area	0 Byte (All systems except PROFIBUS) 1 Byte (PROFIBUS)
Output address area	0 Byte

Configuration and parameter data in a PROFIBUS system	
Required parameter data	1 Byte
Required configuration data	6 Byte

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
Communications supply / functional ground	500 V AC, 50 Hz, 1 min.

Mechanical tests	
Vibration resistance in acc. with EN 60068-2-6/ IEC 60068-2-6	5g
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock according to EN 60068-2-27/ IEC 60068-2-27	10g

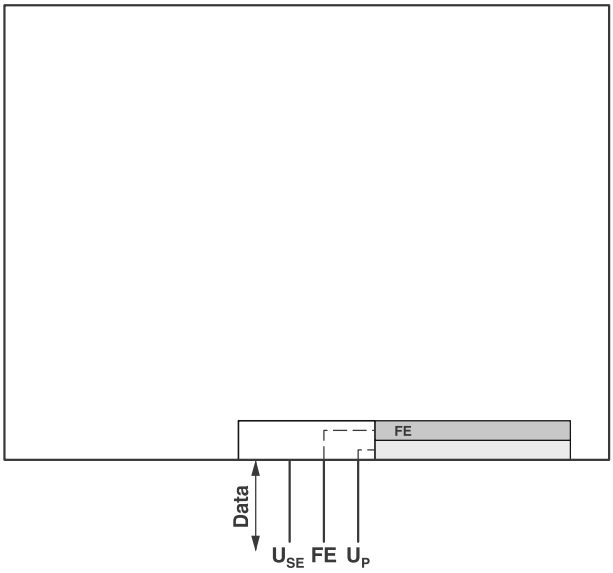
Conformance with EMC Directive 2014/30/EU	
Noise immunity test in accordance with EN 61000-6-2	
Electrostatic discharge (ESD) EN 61000-4-2/ IEC 61000-4-2	Criterion B, 6 kV contact discharge, 8 kV air discharge
Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) EN 61000-4-4/IEC 61000-4-4	Criterion B, 2 kV
Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A, Test voltage 10 V
Noise emission test as per EN 61000-6-4	Class A

Approvals

For the latest approvals, please visit phoenixcontact.net/products.

5 Internal circuit diagram

Figure 1 Internal wiring



Key:

Data	Data transmission
U_{SE}	Communications power supply of the Smart Element
FE	Functional ground
U_P	I/O supply of the Smart Element
	Electrically isolated areas

6 For your safety

6.1 Intended use

Use Smart Elements exclusively in accordance with the specifications in the data sheet and the “Axioline Smart Elements” user manual.
Please also refer to the documentation for the system in which the Smart Elements are used.

6.2 Qualification of users

The use of products described in this data sheet is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

6.3 Disconnecting or plugging in a Smart Element

NOTE: Damage to contacts or malfunction

Before performing work on a Smart Element, disconnect the power to the Smart Element.

This means:

- Switch off the I/O supply voltage U_P!
- Switch off the communications power U_{SE}. For the system in which the Smart Element is used, this means the following: Switch off the voltage that generates the U_{SE}.

6.4 Locking a Smart Element

Make sure that each Smart Element is locked in its slot. This is only ensured if the unlocking mechanism has been pushed into the guide as far as it will go.

See also “Axioline Smart Elements” user manual.

6.5 Applications with UL approval

CAUTION!

– The device has to be built-in the final safety enclosure, which has adequate rigidity according to UL 61010-1, -2-201 and meets the requirements with respect to spread of fire.

Information:

To install the device according to the UL/CSA/IEC standard, the following rules must be observed.

– If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

7 Terminal point assignment and diagnostic indicators

This Smart Element does not have any terminal points or diagnostic LEDs.

8 Parameter, diagnostics and information (PDI)

Parameter and diagnostic data as well as other information are transmitted as objects via the PDI channel.

For more detailed information on all possible standard objects for Axioline Smart Elements, please refer to the UM EN AXL SE SYS INST user manual.

The standard objects necessary for operation are described in the following section.

The information below applies to the following table:

Abbreviation	Meaning
A	Number of elements
L	Length of the elements in bytes
R	Read

9 Standard objects

Index (hex)	Object name	Data type	A	L	Rights	Meaning/contents		Startup parameters	
Device type									
0037	DeviceType	Octet string	1	8	R	Device type	0000 0100 0053 1005_{hex}	No	
Diagnostics objects									
0018	DiagState	Record	11	33	R	Diagnostic state		No	*
Objects for process data management									
0025	PDIN	Octet string	1	0	R	Input process data: The object does not contain any data. When reading the object, you receive a positive response.		No	
0026	PDOUT	Octet string	1	0	R	Output process data: The object does not contain any data. When reading the object, you receive a positive response.		No	

The objects identified with * in the last column are described in more detail in the following sections.

The description of the other objects is to be found in the user manual UM EN AXL SE SYS INST.

Diagnostics state (0018_{hex}: DiagState)

This object is used for a structured message of an error.

A detailed description of the object is provided in user manual UM EN AXL SE SYS INST.

Possible error codes

Subindex	02	03	04	08	0B
Error	Priority	Channel	Error code	Function group	Text
	hex	hex	hex		
No error	00	00	0000	General	Status OK

Key

Priority	00_{hex}	No error
Channel	00_{hex}	No error

10 Device descriptions

The device is described in the device description files.
The device descriptions for controllers from Phoenix Contact are included in PC Worx and PLCnext Engineer, as well as in the corresponding service packs.
The device description files for other systems are available for download at phoenixcontact.net/products in the download area of the bus coupler installed.

Manualslib.com - Simplified Manuals

HMS NETWORKS EWON COSY+ USER MANUAL

ENGLISH

Ewon® Cosy+

USER MANUAL

UM-0006-00 1.2 en-US
Publication date 03-11-2022

Important User Information

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1. Preface

1.1. About this document

This document presents the features of the Ewon® Cosy+ and explains briefly the steps to configure your Ewon for remote access.

For additional related documentation and file downloads, please visit www.ewon.biz/support.

1.2. Document History

Version	*Date*	*Description*
1.0	2021-03-01	First release
1.1	2022-11-03	Adapted for Firmware 21.1

1.3. Related Documents

Document	*Author*	*Document ID*
eBuddy	HMS	AUG-0063-00
Talk2M	HMS	AUG-0028-00
eCatcher Mobile	HMS	AUG-0072-00
M2Web	HMS	AUG-0058-00
Wan Fallback	HMS	KB-0286-00

1.4. Trademark Information

Ewon® is a registered trademark of HMS Industrial Networks SA. All other trademarks mentioned in this document are the property of their respective holders.

2. Introduction

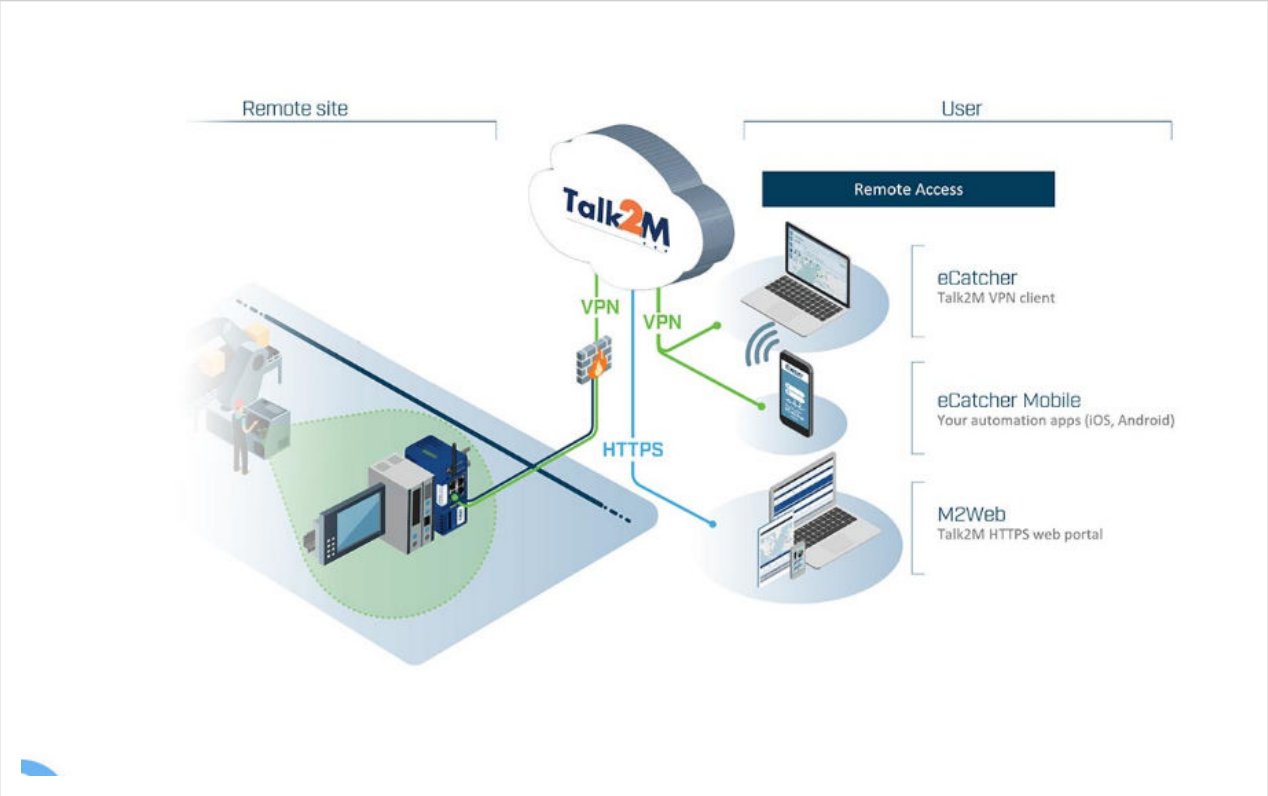


Figure 1. Ewon Cloud Services

Your Ewon industrial gateway can establish a secure VPN connection between your machine (PLC, HMI, or other devices) and you, from anywhere, at any time. The connection happens through Talk2M, a highly secured industrial cloud service.

Once your Ewon device is connected to Talk2M, you can log in to your Talk2M account using the eCatcher client software and securely access your automation devices for monitoring or maintenance purposes.

3. Requirements

3.1. Hardware

You need the following hardware equipment:

- an Ewon® Cosy+
- a USB drive (recommended)
- WiFi or Cellular antenna may be required, depending on your hardware configuration. See the installation guide for more information.

3.2. Software

eCatcher

eCatcher is the VPN client software that allows you to connect remotely to your Ewon® Cosy+.

eCatcher is also your Talk2M account administration software. With eCatcher, you can create and configure your Talk2M account and manage your Ewon devices.

Download eCatcher

[optional] Web Browser

You can configure the Ewon® Cosy+ through its web interface which is accessible from any modern web browser.

NOTICE
We recommend to update or install the latest version of your internet browser (Chrome, Firefox, Edge, Safari, ...).

[optional] eBuddy

The eBuddy application can assist you with the initial IP address configuration for the Ewon® Cosy+ as well as maintenance tasks such as creating and restoring backups.

Download eBuddy.

3.3. Firmware

To follow this guide, your Ewon® Cosy+ should run firmware 21.1s1 or higher.

TIP
To get the most out of your Ewon® Cosy+, always upgrade your Ewon device to the latest firmware version.

4. Prepare the Ewon® Cosy+ for Remote Access

In this section, you will see how to configure your Ewon® Cosy+ using eCatcher *Easy setup*. Configuration parameters are saved on a USB drive or SD card which can then be used to configure your Ewon gateway.

With the steps below, you do not need to connect your computer directly to the Ewon gateway during the configuration process.

1. Create your Ewon® Cosy+ on your Talk2M account.
2. Prepare the communication configuration file to be transferred to your Ewon® Cosy+.
3. Apply the Configuration File to the Ewon® Cosy+.

4.1. Create your Ewon® Cosy+ on your Talk2M Account.

The first step consists in listing your Ewon® Cosy+ inside your Talk2M account using the eCatcher software.

IMPORTANT
If you do not have a Talk2M account yet, launch eCatcher and click on **Create a Free+ Account** and follow the prompts on the screen.

To create your Ewon® Cosy+ in Talk2M, apply the following procedure:

1. Connect your computer to the Internet.
2. Open eCatcher and log in to your Talk2M account.

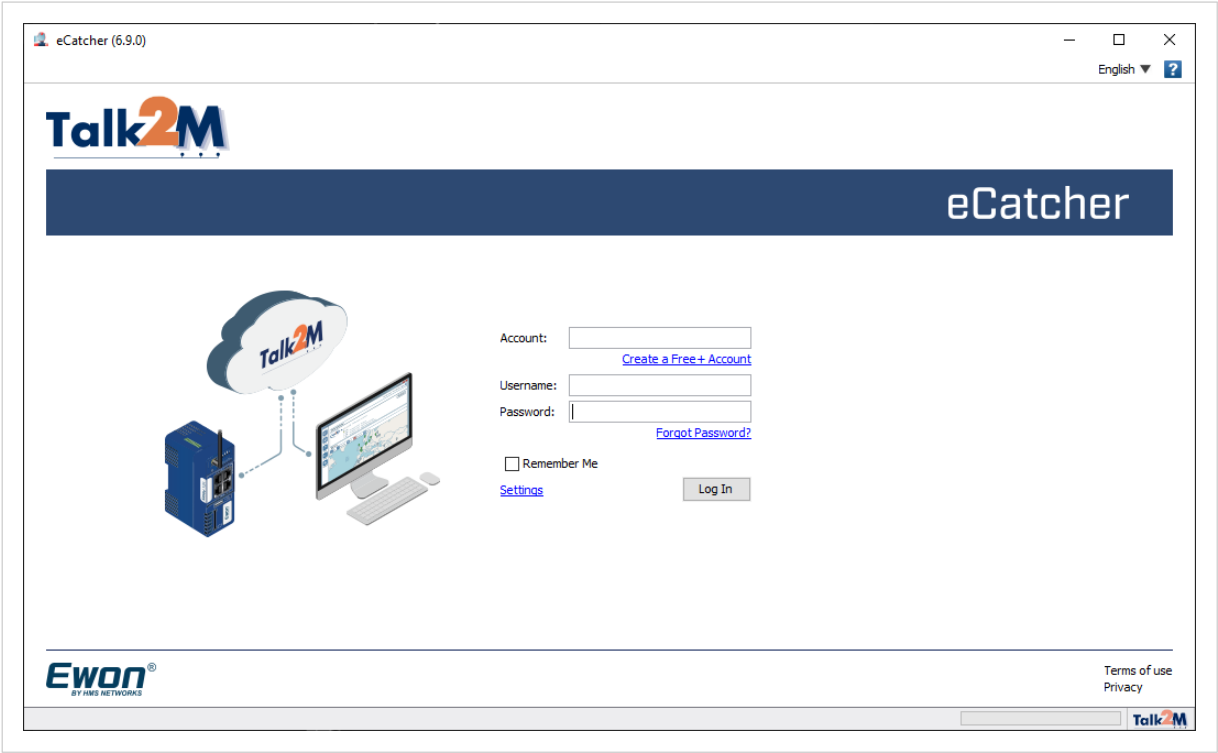


Figure 2. Log in to your Talk2M account

3. On eCatcher's main interface, click the + Add icon. A new window appears.

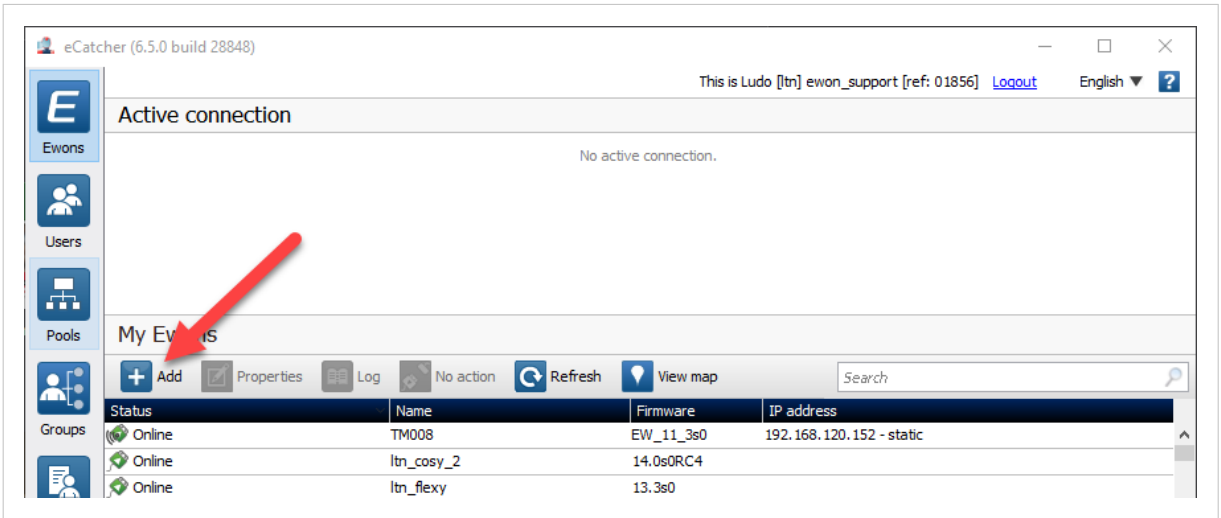


Figure 3. **Add an Ewon in eCatcher — 1**

4. Enter the name of your Ewon® Cosy+. The Talk2M server displays this name to identify the remote connection to your Ewon® Cosy+.
   The name should help you identify the remote equipment. Some examples include a location name, a job number, or a machine's serial number.
5. Select the ***Connection Type*** to specify how your Ewon® Cosy+ connects to the internet. You can choose between:
   a. Permanent: for Ethernet, Wi-Fi or cellular models. Your Ewon® Cosy+ stays permanently online.
   b. Triggered: only for cellular models. Your Ewon® Cosy+ is offline until you wake it up with an SMS.
      If you specify a triggered connection, eCatcher asks for the phone number for the SIM card in your Ewon® Cosy+. The phone number allows Talk2M to send an SMS which wakes up your Ewon® Cosy+.

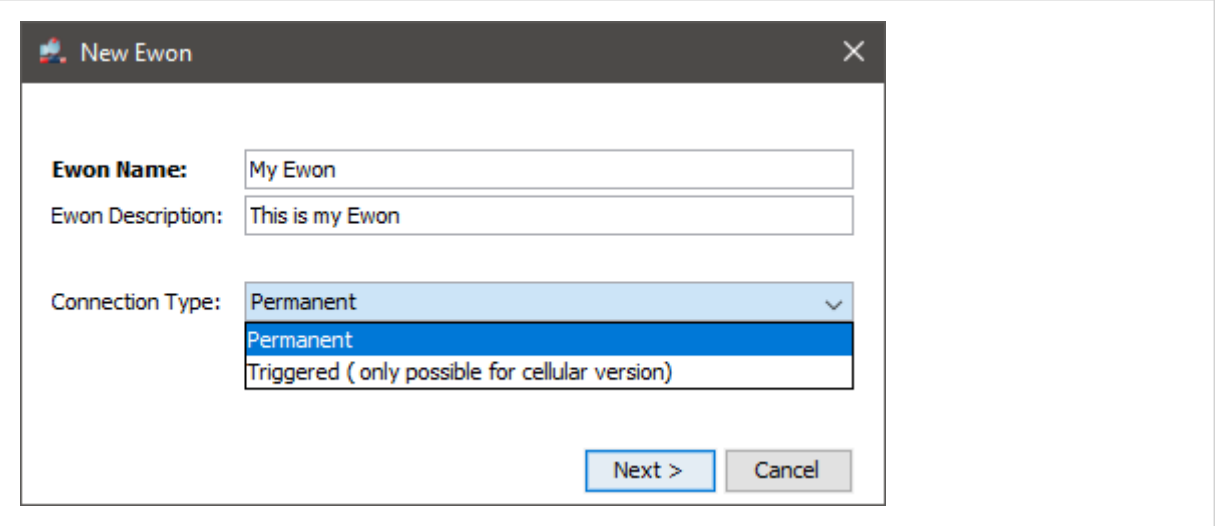


Figure 4. **Add an Ewon in eCatcher — 2**

6. Click ***Next***.

7. (optional) Enter custom information concerning your remote connection. You can use the ***Custom Fields*** to classify or filter your different Ewon devices.

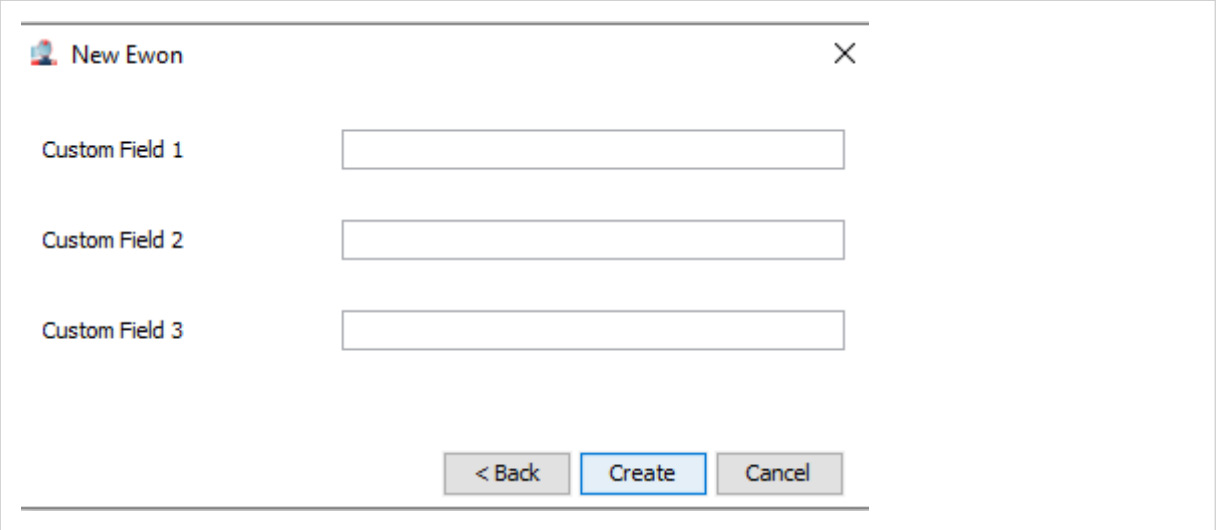


Figure 5. **Add an Ewon in eCatcher — 3**

8. If you are logged in to a Talk2M PRO account, you need to associate your Ewon® Cosy+ with an Ewon Pool. Ewon Pools are ways to group Ewon devices to manage user access rights.
9. Click ***Create***.
   The newly created Ewon® Cosy+ is now linked to your Talk2M account. eCatcher displays the "Talk2M Connectivity" frame.

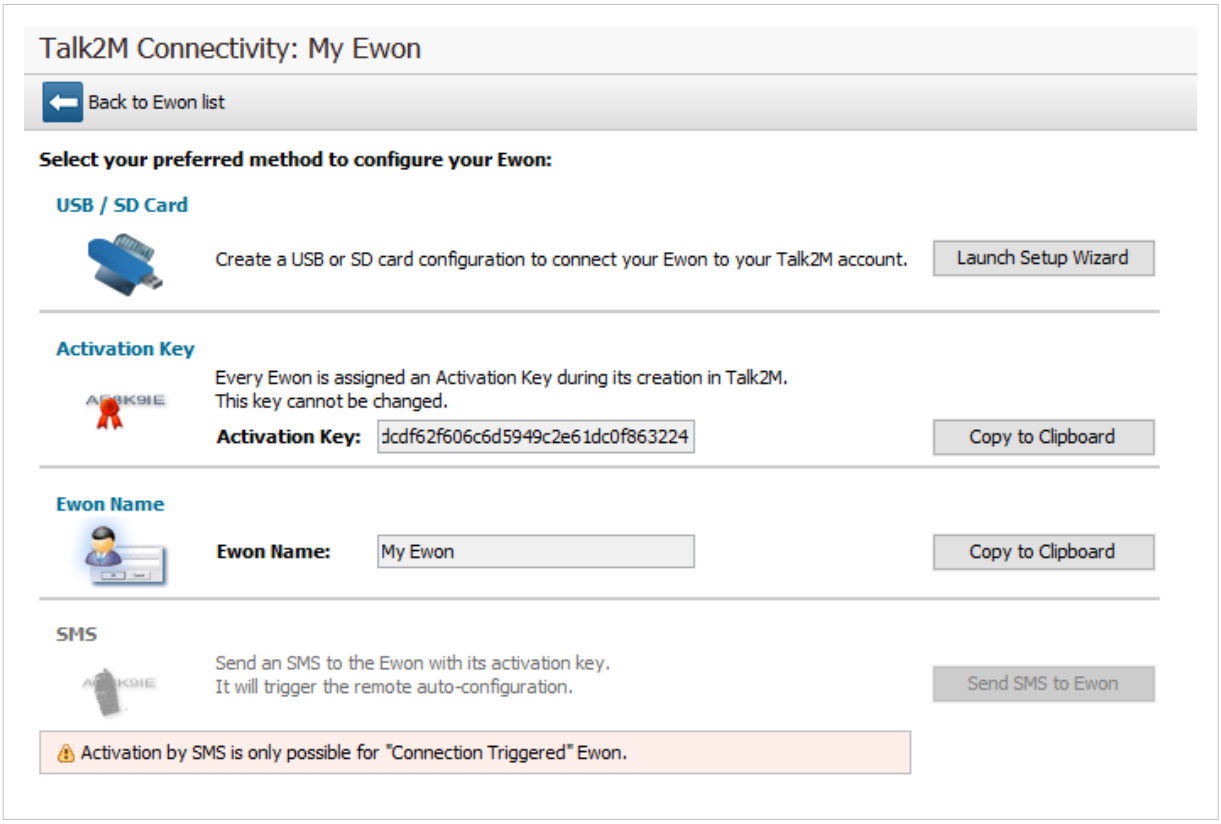


Figure 6. **Talk2m Connectivity in eCatcher**

4.2. Prepare the Communication Configuration File

To remotely access your Ewon® Cosy+, you need to configure the internet and Talk2M VPN connection settings of your Ewon® Cosy+.

eCatcher offers the possibility to create a commissioning file which includes all the configuration parameters required for such connections.

eCatcher stores the commissioning file on an SD card or a USB flash drive. You can then insert the SD card or USB flash drive in your Ewon® Cosy+ which automatically applies the configuration parameters.

IMPORTANT
To apply the following configuration, your Ewon® Cosy+ must run firmware version 21.1s0 or higher.

Once eCatcher displays the “Talk2M Connectivity” frame, complete the following steps:

1. Click the ***Launch Setup Wizard*** button of the ***USB/SD card*** row.
2. Enter the Ewon name. The name entered here will appear in the web interface of the Ewon® Cosy+. It can be different than the name displayed by Talk2M.
3. Select a language for the web interface of the Ewon® Cosy+ from the drop-down menu.
4. Select the Timezone where the Ewon® Cosy+ will be installed. This information is used to automatically set the date and time on the Ewon® Cosy+.
5. Enter a password for the Ewon® Cosy+.The password must:
   - have minimum length: 12 characters
   - have maximum length: 35 characters;
   - have only characters from the latin-1 set (ISO-8859-1);
   - respect 3 of the following conditions:
   at least one lowercase character,
   at least one uppercase character
   at least one digit,
   at least one special character.
6. Click **Next**.
7. Select the WAN interface of your Ewon gateway.
8. Depending on the interface you choose, different configuration fields are required:
   a. Ethernet: WAN IP settings.
   b. Wi-Fi: SSID settings.
   c. Cellular: SIM card and APN settings.

   For Ethernet and Wi-Fi, make sure to complete the advanced settings if necessary.
9. Click ***Next***.
10. Set the LAN IP address of your Ewon® Cosy+.
11. Click **Next**.
12. Insert an SD card or USB flash drive in your computer. Make sure the card or the drive is FAT32 format.
13. Select the location where eCatcher should export the file.
14. Click ***Save*** twice to confirm the export.

The last screen is an explanation how to proceed with the SD card / USB flash drive and your Ewon® Cosy+.

4.3. Apply the Configuration File

To configure your Ewon® Cosy+ for remote access, you need to apply the *Configuration File* and follow the procedure below:

1. Before beginning, make sure
   a. Your Ewon® Cosy+ is powered on
   b. Your Ewon® Cosy+ can connect to the internet. Depending on your configuration this could mean:
      i. The WAN cable is plugged in. The WAN port of the switch is represented by an orange LED.
      ii. The SIM card has been inserted into the device and the cellular antenna is attached.
      iii. The Wi-Fi antenna is attached.
2. Insert the SD card or the USB flash drive in your Ewon® Cosy+.
3. Check the status of the USR LED.
   a. First, the Ewon® Cosy+ detects the insertion of the SD card or USB drive. The USR LED blinks orange quickly (ON / OFF every 150 msec).
   b. Next, the Ewon® Cosy+ processes the configuration files. During this process, the USR LED blinks orange slowly (ON / OFF every second).
   c. Once the files are processed, the Ewon® Cosy+ updates the USR LED to indicate if the configuration files were successfully applied.
      -**solid green**: success
      -**solid red**: failure
4. Remove the SD card or the USB drive. When the SD card or USB drive is removed, the Ewon® Cosy+ reboots.
5. Wait several minutes.
   Once the Ewon® Cosy+ reboots, it attempts to connect to Talk2M. This process can take several minutes. When the process is successful, the T2M LED turns on and the Ewon® Cosy+ appears online in eCatcher.

4.4. Connection Troubleshooting

1. Your Ewon is configured for the second time.
   If you configure your Ewon for a second time, note that the initial configuration was probably partly applied.

IMPORTANT
Inside the USB wizard you need to use the "*Device already configured*" option to encode your existing password.

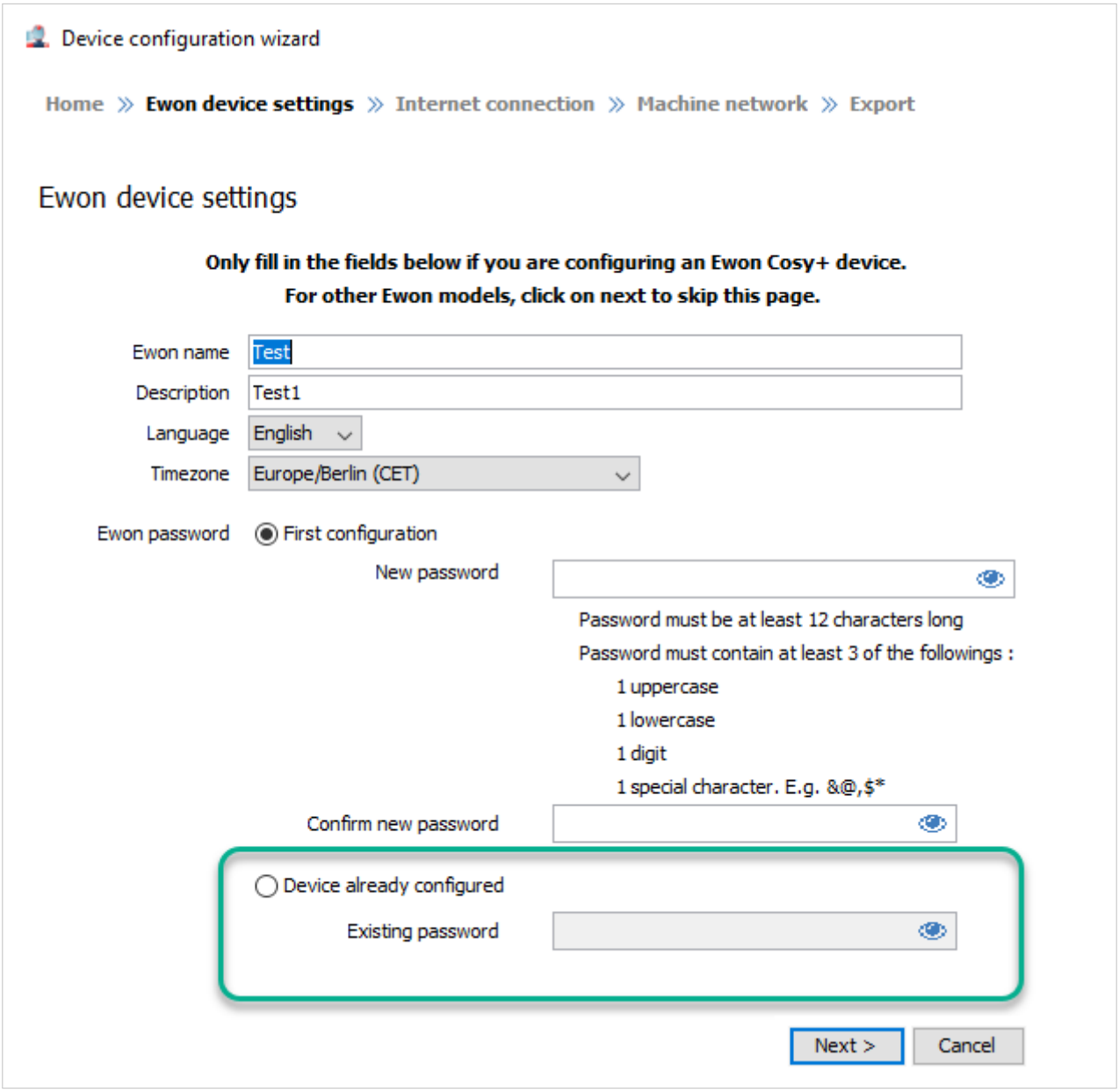


Figure 7. Configuration Wizard - Device already configured

5. Connect to your Ewon® Cosy+ Remotely

Once your Ewon® Cosy+ is connected to Talk2M you can establish a remote connection to it.
The connection procedure is different depending on the *Connection Type* you select when you create your Ewon Cosy+ on your Talk2M Account (page 4).

5.1. Permanent Connection

To connect remotely to an Ewon® Cosy+ tagged as permanent connection, follow the procedure:

1. Connect your computer to the Internet. Verify that your Internet connection is stable.
2. Open eCatcher (if not already opened).
3. Select your Ewon® Cosy+ recently configured from the “My Ewons” list menu.
4. Click the green **Connect** button displayed in the list menu to establish the remote connection. When you click **Connect**, eCatcher establishes a VPN connection to the Talk2M server from your PC.

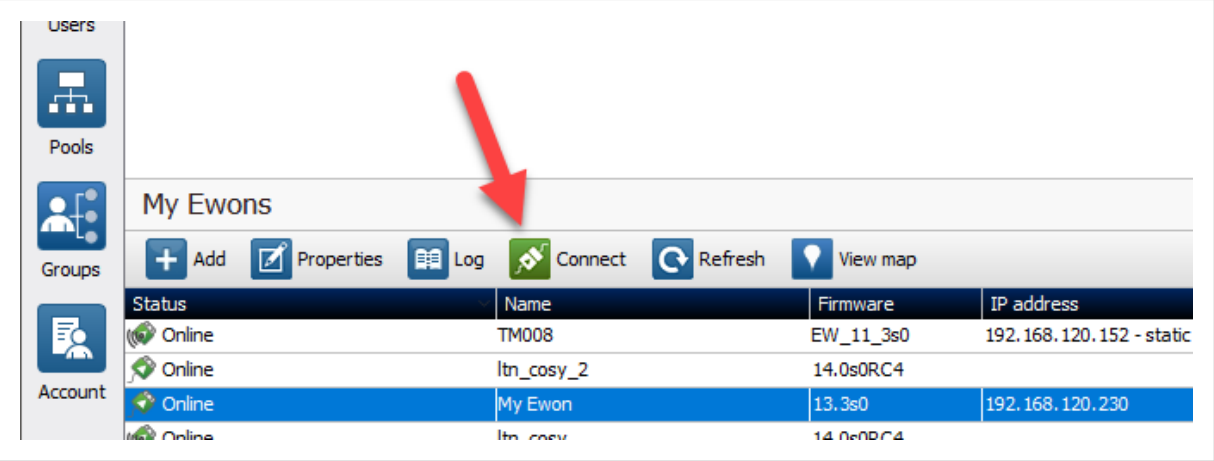


Figure 8. Connection to an Ewon Cosy+

5. Once the VPN connection established, eCatcher displays the Ewon® Cosy+ in the “Active connection” section.

The computer is now connected to the Ewon® Cosy+ using the VPN tunnel and you can use the remote connection.

You can click on the *Ewon name* link in the **Active Connection** section to display the homepage of the Ewon® Cosy+ web interface in your web browser.

When you are done with your remote connection, click Disconnect to end the VPN connection.

5.2. Triggered Connection

To connect remotely to an Ewon® Cosy+ tagged as triggered connection, follow the procedure:

1. Connect your computer to the Internet. Verify that your Internet connection is stable.
2. Open eCatcher (if not already opened).

3. Select the Ewon® Cosy+ you just configured in the "My Ewons" list menu.

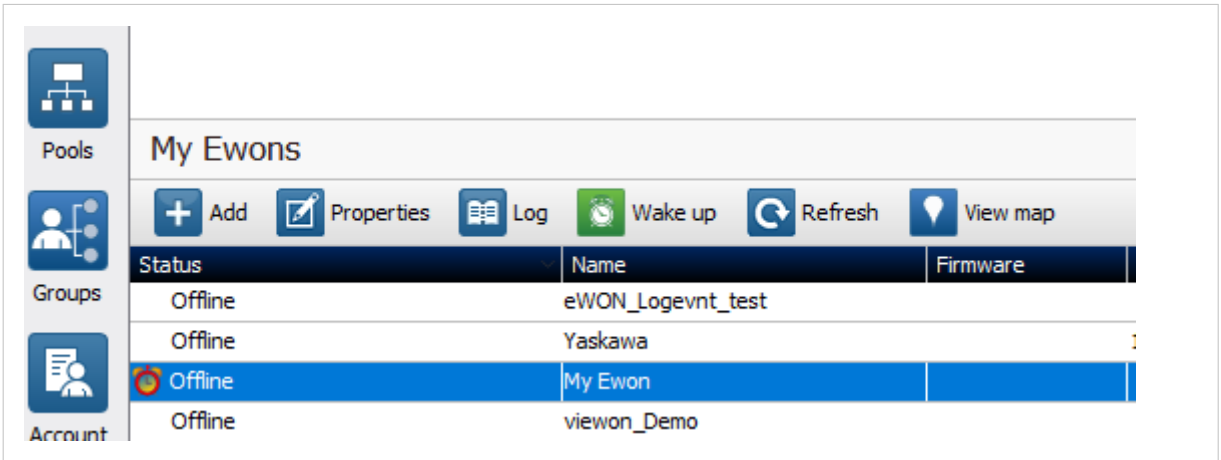


Figure 9. **Wake up your Ewon Cosy+ — 1**

4. Click the **Wake up** button to wake your Ewon® Cosy+. Wait until the Ewon status changes to **Online** and then proceed to the next step

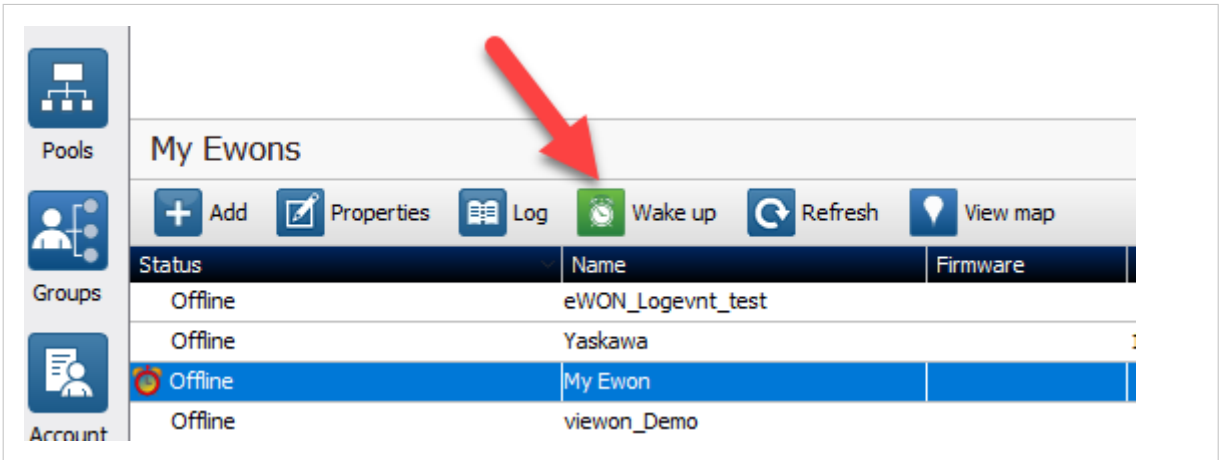


Figure 10. **Wake up your Ewon Cosy+ — 2**

5. Click the green ***Connect*** button (previously ***Wake up*** button) once the Ewon® Cosy+ changes status to <Online>. The <Connect> button is displayed in the Ewon® Cosy+ list menu and establishes the remote connection. eCatcher is now attempting to establish a VPN connection to the Talk2M server.

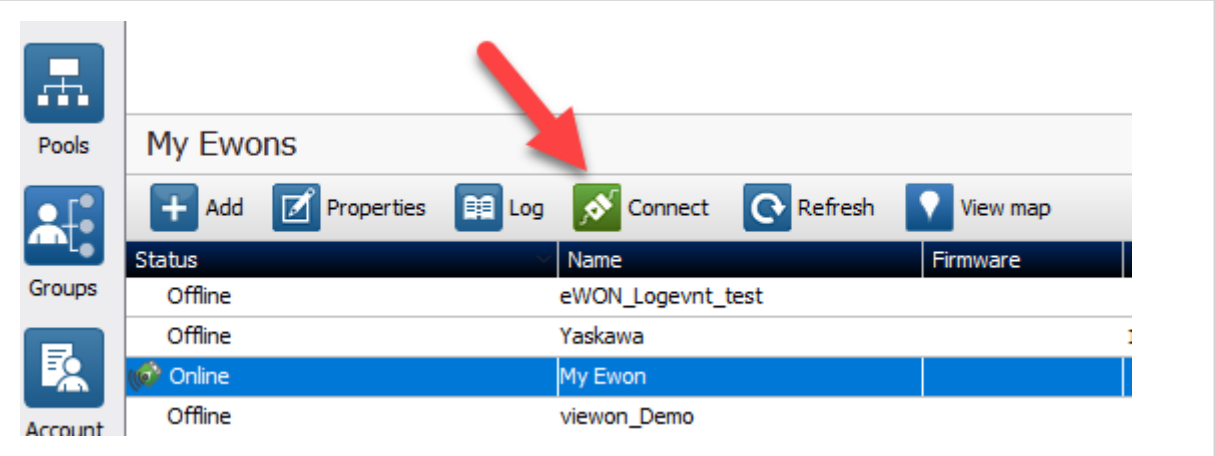


Figure 11. **Wake up your Ewon Cosy+ — 3**

6. Once the VPN connection established, eCatcher displays the Ewon® Cosy+ in the “Active connection” section.

NOTICE
With your smartphone, you can also send the SMS “Talk2M_Connect” or “Talk2MConnect” to your Ewon® Cosy+ to wake it up.

The computer is now connected to the Ewon® Cosy+ using the VPN tunnel and you can use the remote connection.

You can click the ***Ewon Name*** link in the “Active Connection” section to display, in a web browser, the homepage of the Ewon® Cosy+ web interface.

When you are done with your remote connection, click **Disconnect** to end the VPN connection.

After you disconnect from the Ewon® Cosy+, click the **Go Offline** button to close the Ewon® Cosy+’s internet connection.

6. Ewon® Cosy+ Interface Homepage

The *Summary* page or home section, shows at a glance information about the health and status of the Ewon® Cosy+. Its current Internet connection and VPN connection status, date and time, and firmware versions are all displayed.

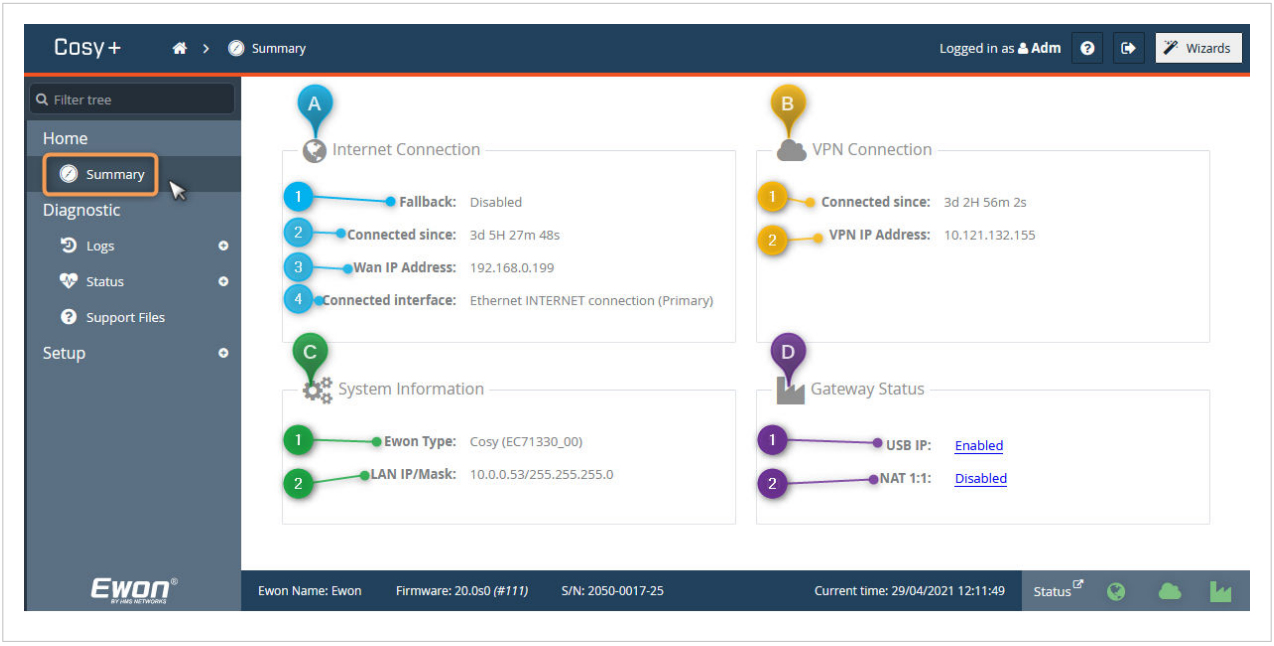


Figure 12. Summary Page - Exemple

A - Internet Connection

1. **Fallback** : The status of the WAN fallback feature. For more information about the WAN fallback, check the Wan fallback (page 20)
2. **Connected since** : Elapsed time since the Ewon® Cosy+ is connected to the Internet.
3. **WAN IP Address** : IP address of the WAN connection.
4. **Connected interface** : WAN interface used to connect the Ewon® Cosy+ to the Internet.

B - VPN Connection

1. **Connected since** : The elapsed time since the Ewon® Cosy+ is connected to the VPN service. This field doesn't appear if the VPN connection hasn't been configured.
2. **VPN IP Address** : The IP address of the VPN connection. This field doesn't appear if the VPN connection hasn't been configured.

C - System Information

1. **Ewon Type** : The model of the device.
2. **LAN IP/Mask** : The LAN IP address and subnet mask of the device. By default: 10.0.0.53/255.255.255.0

D - Gateway Status

1. **USB** : Status of the USB connectivity. By default, it is activated. Possibility to change this status by clicking on it.
2. **NAT 1:1** : Status of the NAT 1:1. By default, it is deactivated. Possibility to change this status by clicking on it.

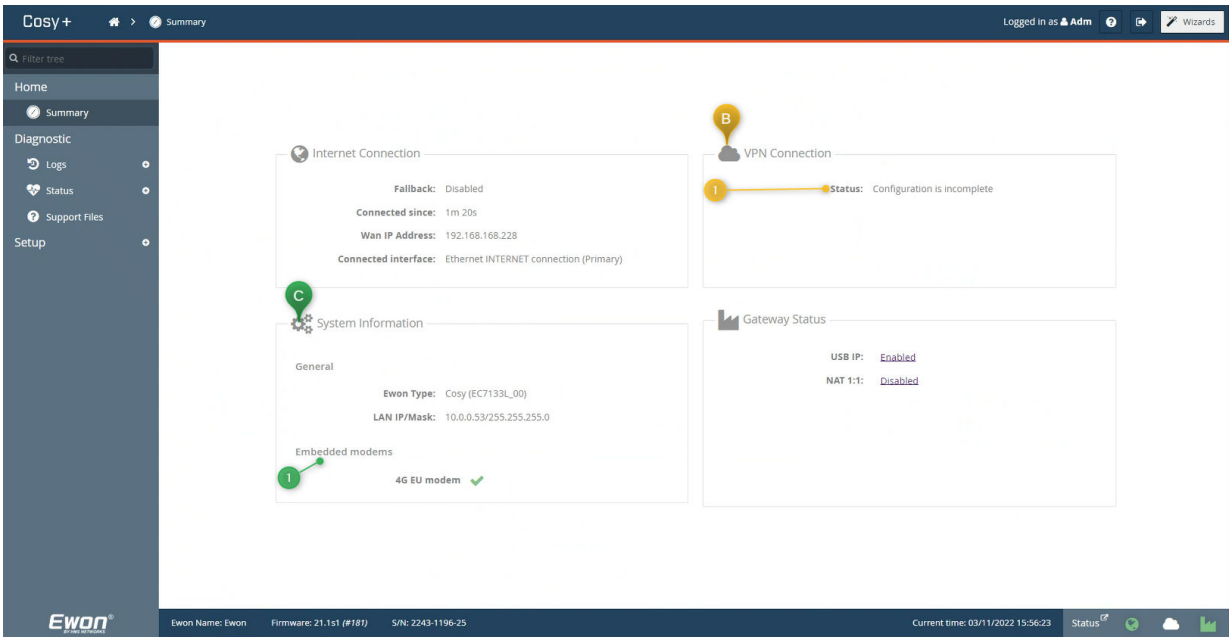


Figure 13. Summary Page - Exemple

B - VPN Connection

1. **Status** : This field appears only if the VPN connection of the Ewon® Cosy+ hasn't been configured.

C - System Information

1. **Embedded modems** : The type of modem embedded in the Ewon® Cosy+ : Wi-Fi or cellular (3G/4G). This field appears only if the model of the Ewon® Cosy+ is equipped with a Wi-Fi or a cellular modem.

7. Remote Access Methods

Once your Ewon® Cosy+ is connected to Talk2M, you can access your Ewon device and your remote equipment in different ways based on your remote access needs.

You can use:

- **eCatcher:** Ewon's VPN client software for Windows laptops and desktops
- **eCatcher mobile:** Ewon's VPN client application for Android and iOS devices
- **M2Web:** Ewon's web portal to access certain types of remote equipment from any device with a web browser

eCatcher:

eCatcher is Ewon's free VPN client software for Windows laptops and desktops. It provides full VPN access to your remote Ethernet and USB devices allowing you to interact with them as if you were on the same network.

eCatcher is also your Talk2M account administration tool. Account administrators can use eCatcher to manage the Talk2M account including adding and deleting users and devices.

eCatcher Mobile

eCatcher Mobile is Ewon's free VPN client application for Android and iOS devices. eCatcher Mobile provides secure communication between other mobile applications such as vendor specific applications or VNC clients and remote industrial equipment.

With eCatcher Mobile, when you log in to your Talk2M account, you can see and connect to your accessible Ewons. Once connected, you can run your third-party apps and interact with your equipment as if you were on the same network.

Find more information about using eCatcher mobile in the document *eCatcher Mobile App: Connect to an Ewon*: https://resources.ewon.biz/aug-0072

M2Web:

M2Web is a feature of Talk2M that provides secure browser-based mobile access to your remote HMI, web server, PCs, and panels

No special software is required. M2Web is accessible at https://m2web.talk2m.com . With M2Web, you can have mobile access to remote web servers, vnc servers, and Remote Desktop enabled Windows based devices.

Find more information about using M2Web in the document *M2Web Platform*: https://resources.ewon.biz/aug-0058

8. Additional Configuration

In this section you will find some options available within the Web Configuration Interface.

8.1. Remote Access Control

The Ewon® Cosy+ can be configured to allow or prevent remote access based on the state of a digital input.

Click on the *DI Config wizard*. The Digital Input physical connection need to be wired to be used as a function.

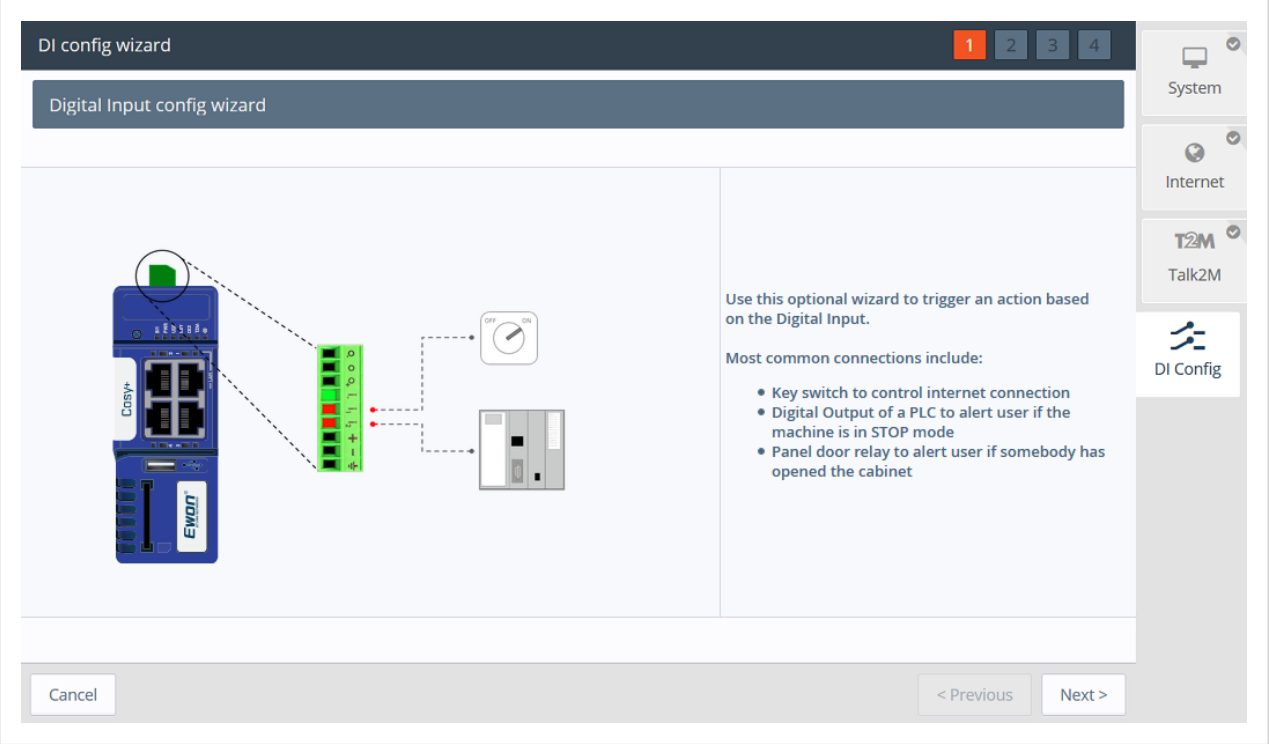


Figure 14. DI Wizard

To enable the remote access control:

- Click the ***Enabled*** checkbox. If enabled, then Talk2M remote access will only be possible at the high state of the digital input 1. Only if the ***Key Switch*** has been enabled.

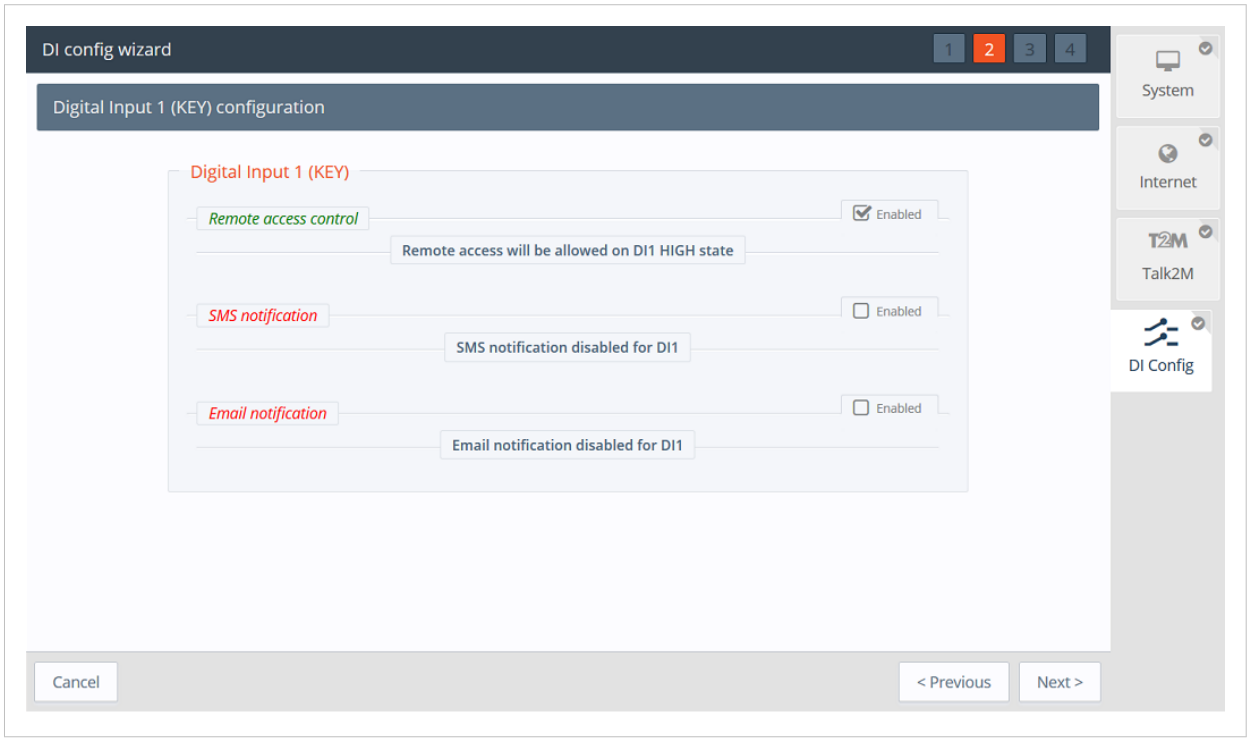


Figure 15. DI Wizard Remote Access Key Configuration

8.2. Alarm Notification

The Ewon® Cosy+ can be configured to send alerts based on the state of its digital inputs.

Click on the *DI Config wizard*. The Digital Input physical connection need to be wired to be used as a function.

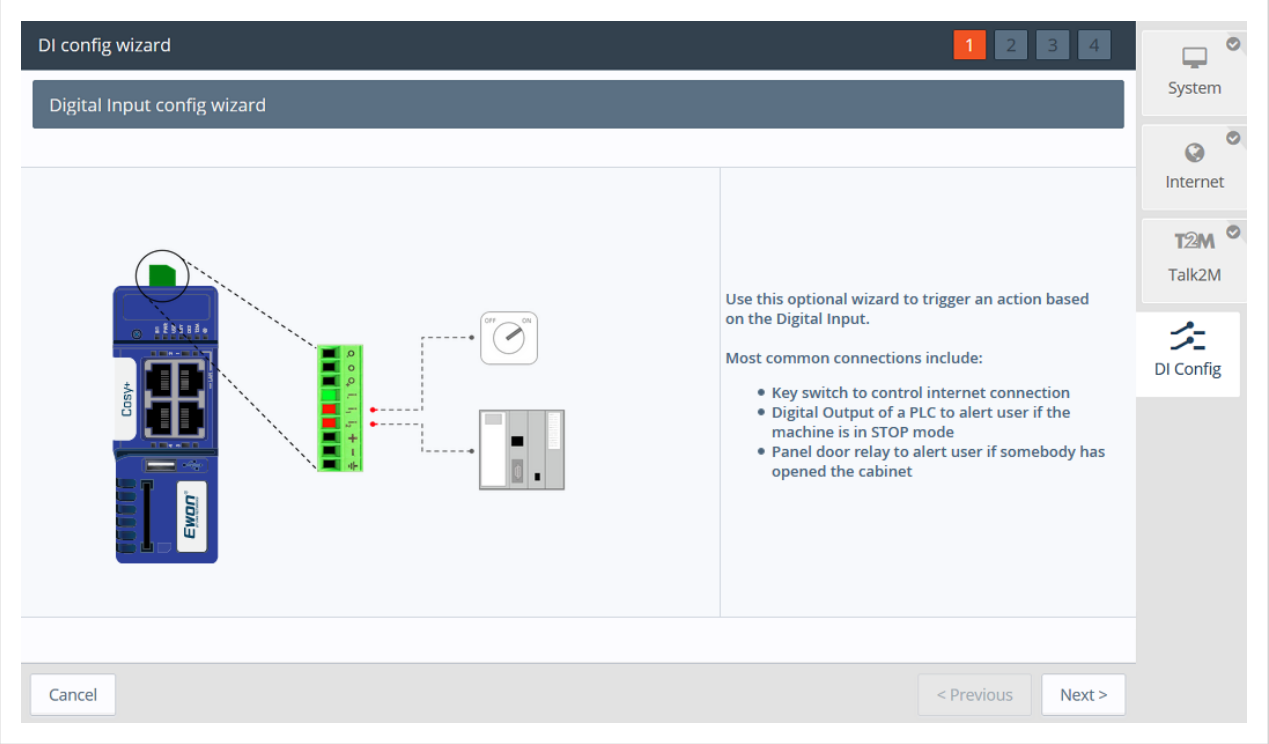


Figure 16. DI Wizard

The following options are valid for *DI1* and *DI2*. For both digital inputs you can setup email or SMS text message notification.

The *DI Config Wizard*: Select the option(s) by simply checking the *Enable* checkbox.

- The *SMS notifications*; enter the phone number, and body of the message accordingly; then a notification will be sent when the *Digital Input* switch on a high state.
- The *Email notification* enter the recipient, subject, and body of the message; then a notification will be sent when the *Digital Input* switch on a high state

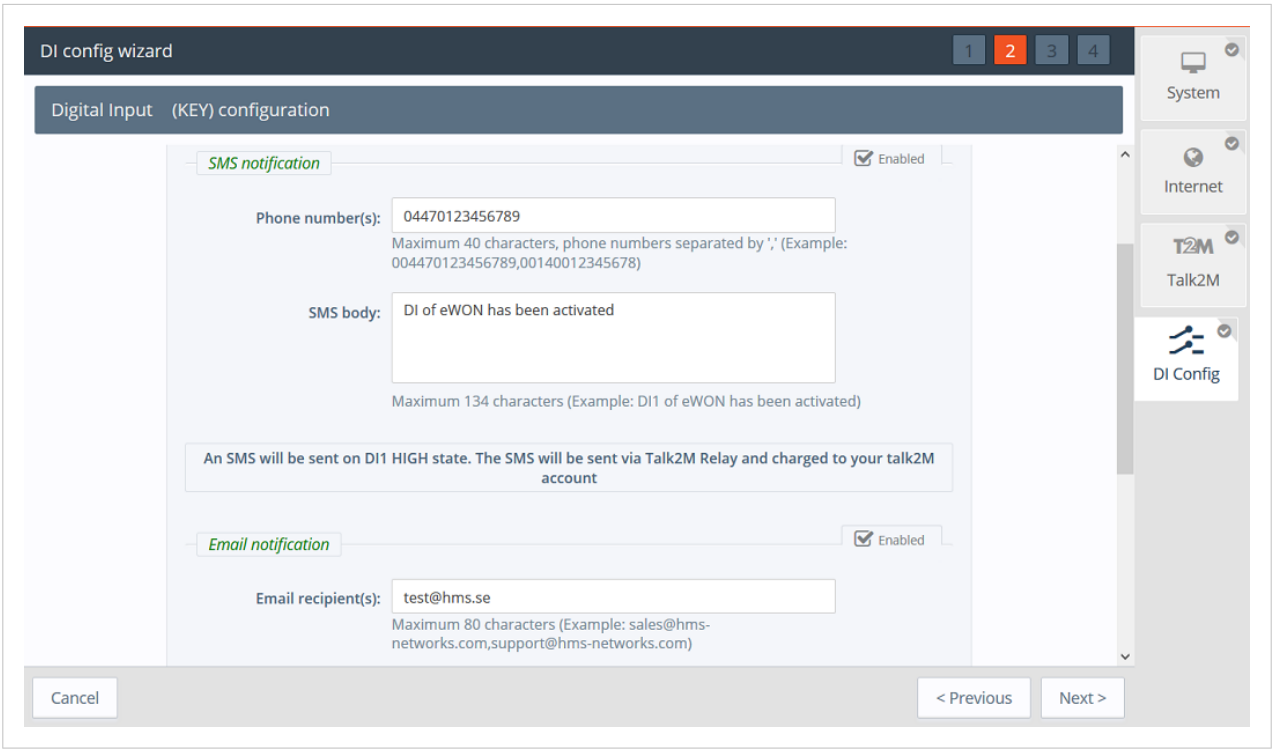


Figure 17. DI Wizard Notification Key Configuration

Click ***Next*** to test and apply the *Digital Input* connection settings.

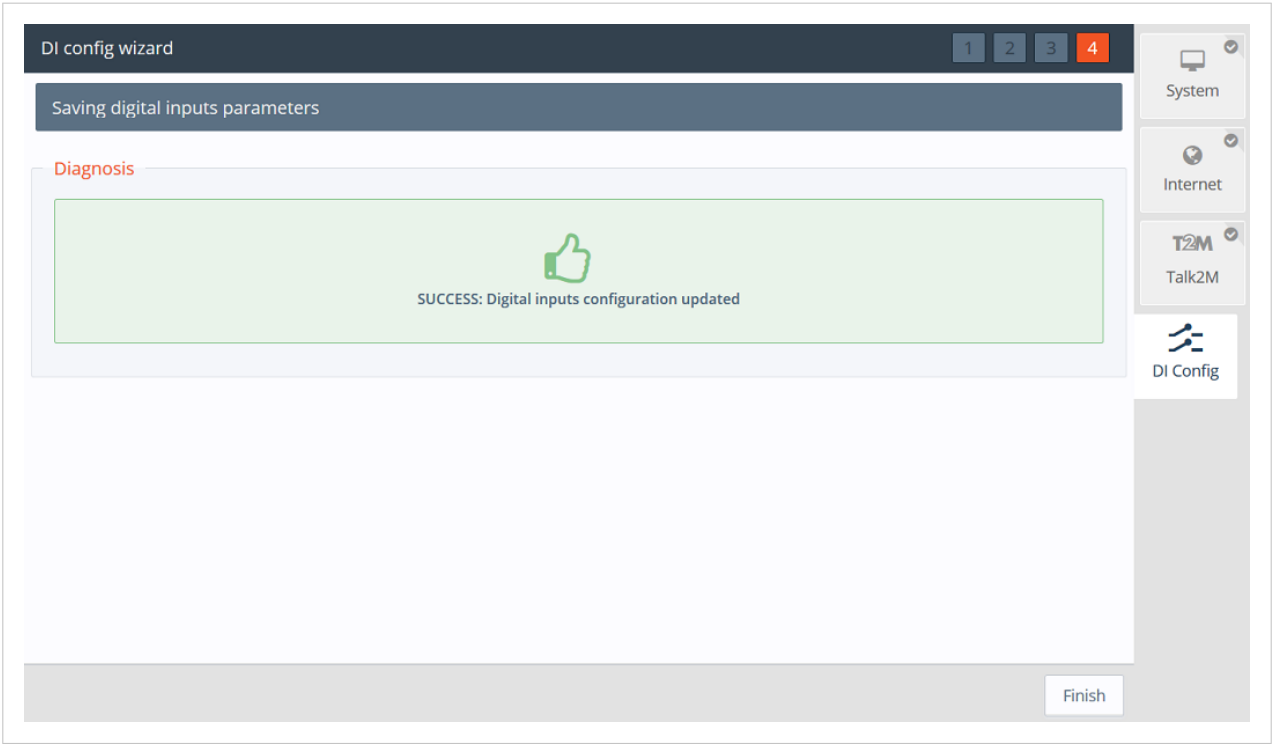


Figure 18. DI Wizard Remote Key Configuration Validation

If the *Digital Input* is on a high state at boot time; then a notification is sent out once the Ewon® Cosy+ is connected to Talk2M and a prefix "(BOOT)" is added to your messages.

IMPORTANT
SMS and email notifications are sent via Talk2M relays, but it requires the Ewon® Cosy+ to have Talk2M connectivity, and charges will apply for every SMS sent.

8.3. WAN Fallback

Ewon® Cosy+ units that support two different possible WAN interfaces, such as Ethernet and WiFi or Ethernet and cellular, can be configured to use the **WAN Fallback** feature. With the WAN fallback feature, the Ewon® Cosy+ switches to its secondary WAN interface automatically when its primary WAN network fails.

To configure the WAN fallback feature, you must connect locally to the web interface of the Ewon® Cosy+ as described in A.3 Access the Web Configuration Interface.

To configure the WAN fallback feature, complete the following steps:

1. Navigate to the Internet Wizard

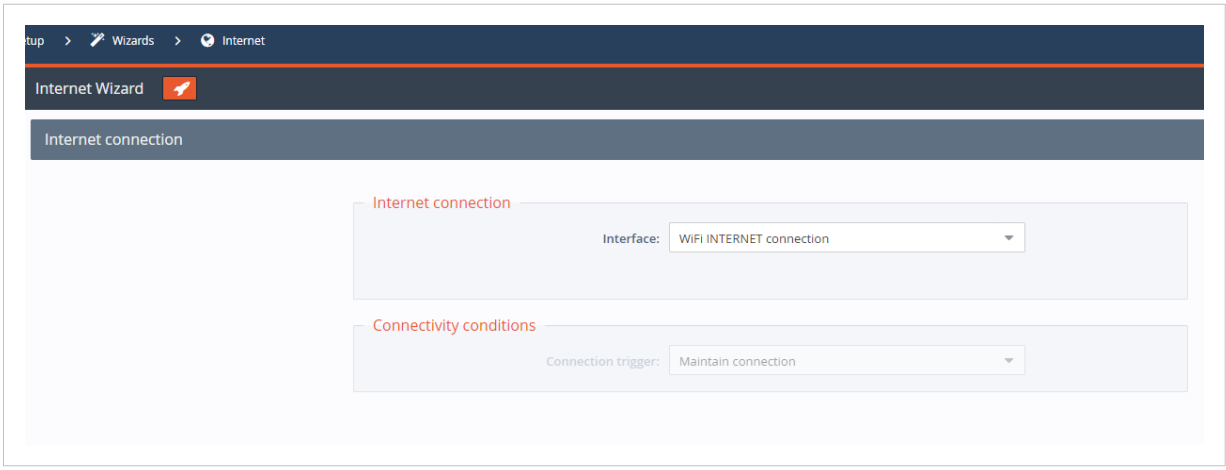


Figure 19. Internet Wizard - Internet Connection

2. Run the Internet Wizard as described in A.4.2 Internet Wizard for the Ethernet interface. This will be the primary interface.

NOTICE
You must run the wizard to configure the Ethernet interface even if the interface has previously been configured.

3. When the Wizard completes, click **Finish**. A dialog box appears.

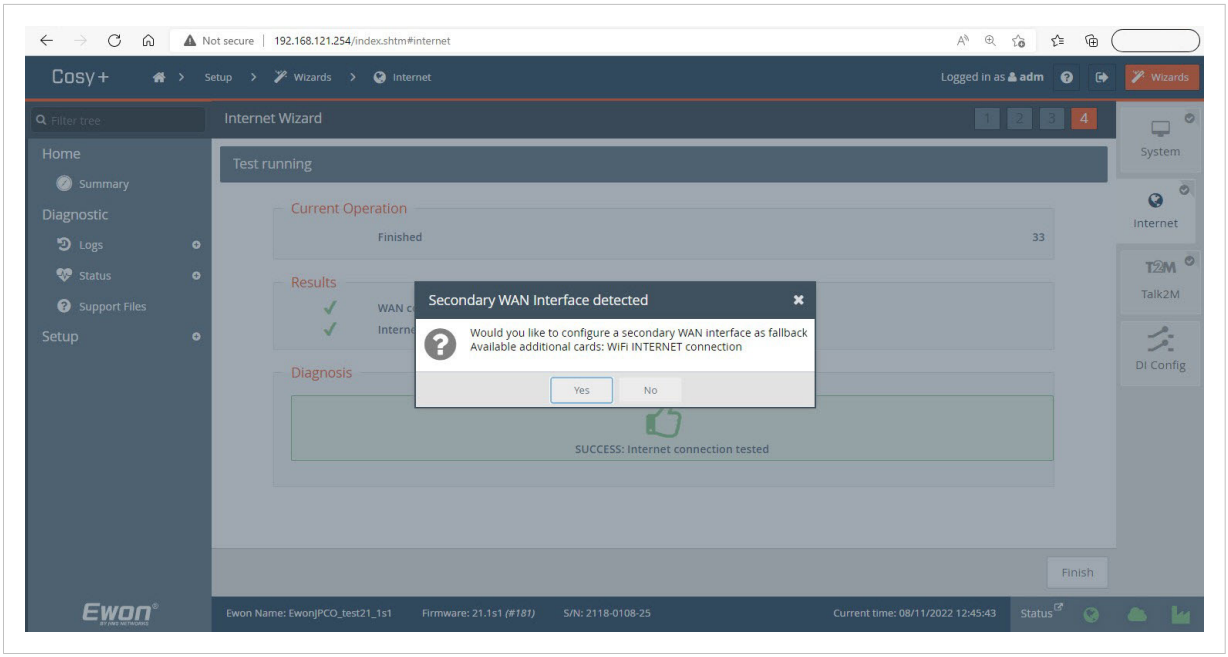


Figure 20. Secondary Wan Detected

4. Click **Yes**.
5. Run the Internet Wizard as described in A.4.2 Internet Wizard for the secondary interface.

Detailed information about the WAN fallback feature can be found in *KB-0286-00 WAN Connection Fallback for Ewon Cosy and Flexy*: https://resources.ewon.biz/kb-0286 .

9. Firmware Update

Keeping an Ewon device's firmware updated helps protect it against known security threats and gives you access to the latest fixes and features.

NOTICE
During the firmware update process, the Ewon device reboots, which makes the LAN switch temporarily inactive.

There are several different ways to update your Ewon device's firmware to make it easy to keep your Ewon device up to date.

1. **Automatic Firmware Updates**
   The Ewon® Cosy+ offers an embedded **Firmware Update** feature inside its web interface. From this option, you can configure the Ewon® Cosy+ to automatically retrieve and apply firmware updates.

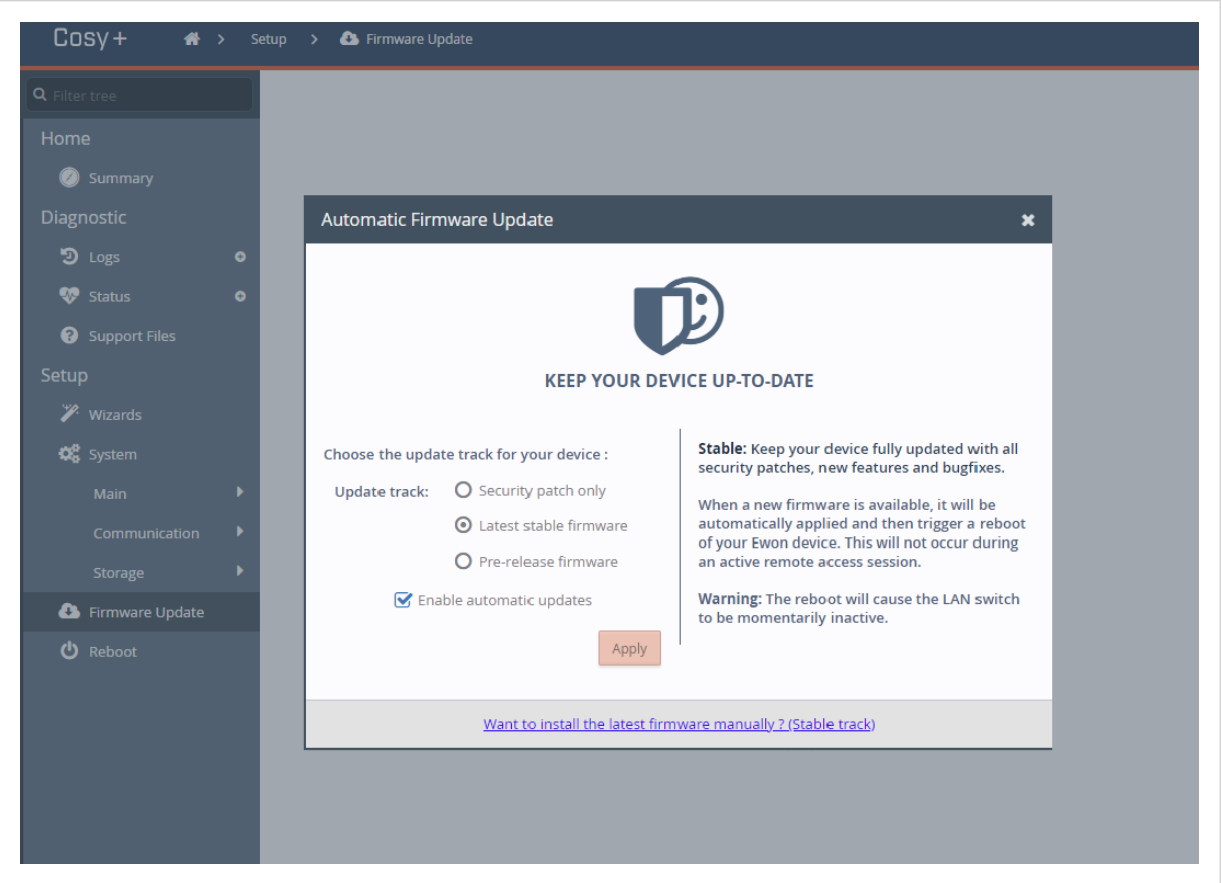


Figure 21. Automatic firmware update

The Cosy+ can be configured to:

- Only automatically apply security patches
- Automatically apply the most recent official release
- Automatically apply the most recent release including pre-release firmware.

NOTICE
Pre-release firmware should be applied only to units for testing purposes unless told otherwise by a support representative.

2. **eCatcher Firmware Management (Talk2M Pro only)**
   Talk2M Pro account administrators can apply firmware updates through eCatcher using eCatcher's firmware management feature. Firmware updates can be applied to a single Ewon® Cosy+ or update requests can be made for multiple Ewon® Cosy+ devices at the same time.

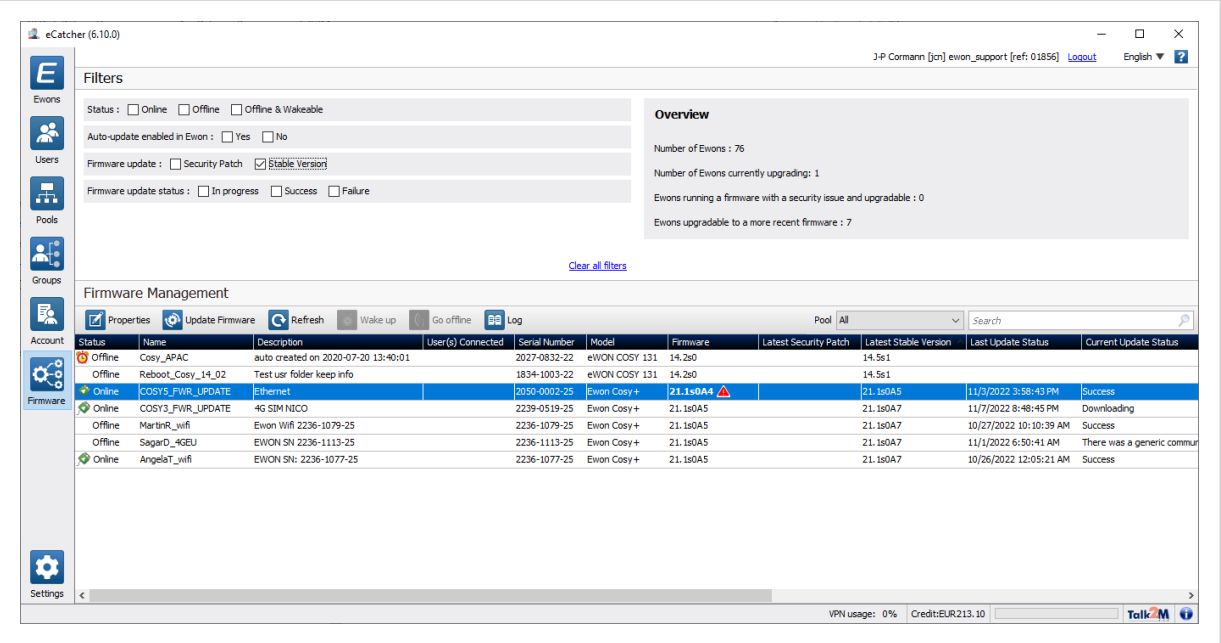


Figure 22. Update Firmware - 1

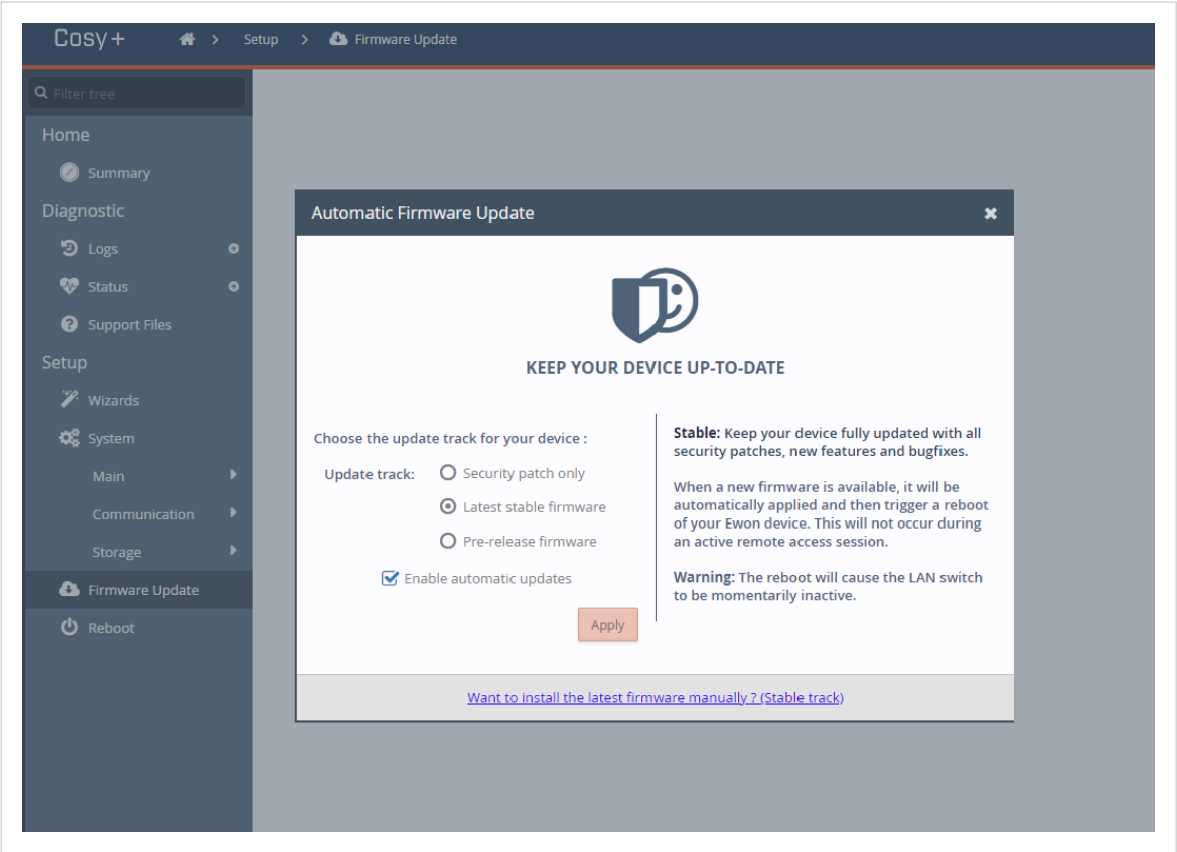
When you click on the *Update Firmware* button, a window pops up with a list of options to upgrade to the latest available firmware or to install a specific firmware version .

NOTICE
The Firmware Management feature requires eCatcher version 6.10 or higher.

3. **Manual Firmware Updates**

   a. *From the Web Interface*

   The embedded **Firmware Update** feature inside the web interface of the Ewon® Cosy+ can be used to manually install the latest stable firmware version.



On the Automatic Firmware Update configuration screen, click the link at the bottom to trigger the installation process. The Ewon® Cosy+ checks to see if a newer firmware version is available. If one is available, the Ewon® Cosy+ retrieves the new firmware file, applies it, and reboots.

Figure 23. Automatic Firmware Update configuration screen

   b. *With a Firmware Update File*

   You can manually update the firmware on your Ewon® Cosy+ by transferring an update file by FTP or from an SD card or USB drive. Instructions for manually updating the firmware can be found on: https://resources.ewon.biz/cosy-plus/firmware

10. Diagnostic and Setup

On the Ewon® Cosy+ , the main configuration setup is done through the Wizard. Nevertheless, on the left hand side menu, there are 2 core options *Diagnostic* and *Setup*.

The *Diagnostic* menu records significant system events on the Ewon® Cosy+ that can be used in case of troubleshooting. An event is given one of three severity levels: *Error*, *Warning* or *Trace* and color coded correspondingly.

The *Setup* menu offers an alternative approach to changing parameters such as *Language*, *Ethernet IP*, or reboot the Ewon® Cosy+.

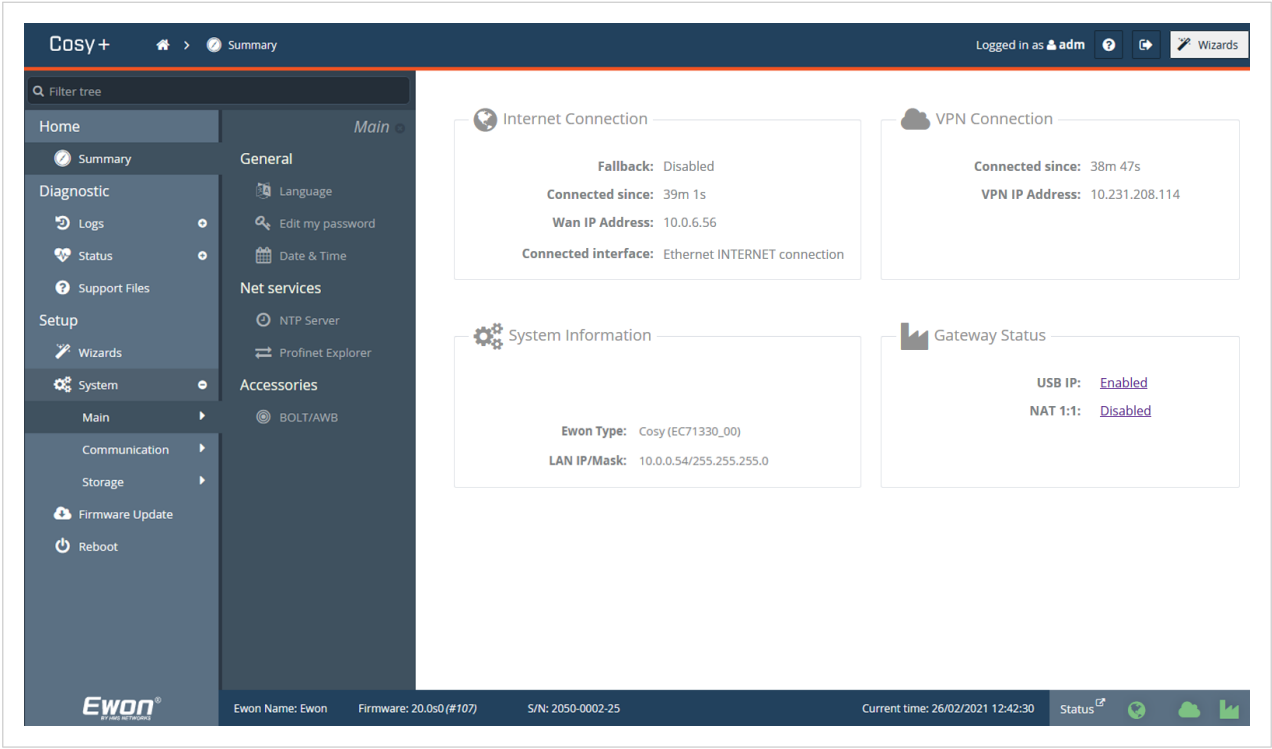


Figure 24. Diagnostic and Setup menu

Appendix A. Alternative configuration for your Ewon device

If for some reasons you could not configure the Ewon using the default USB method explained above, you can also configure the Ewon by using its Web interface.

In this section, we will explain how to configure your Ewon® Cosy+ using the *Embedded Wizard* setup:

1. Assign an IP address to your Ewon® Cosy+, different than the default IP address.
2. Register your Ewon® Cosy+ to a Talk2M account.
3. Access the web interface of the Ewon® Cosy+.
4. Configure your Ewon® Cosy+ using the Embedded Wizard Setup.

1. Assign an IP Address

You can establish the first communication with the Ewon® Cosy+ using the eBuddy application (check Software (page 3) for more details about eBuddy).

By default, the IP address of the Ewon® Cosy+ is set to 10.0.0.53 which in some circumstances might need to be changed.

To change the IP address of the Ewon® Cosy+, proceed as follows:

1. Connect the port labeled as **LAN (port #1)** of the Ewon® Cosy+.
   This can be done either point-to-point (computer & Ewon® Cosy+) or through a network if the default IP of the Ewon® Cosy+ will not conflict with another connected device.
2. Start the eBuddy application.
   The application scans through the Ethernet adapter network, identifies the connected Ewon devices and display their IP address, subnet mask and serial number.
   eBuddy also allows the modification of the default IP address without necessarily being in the same network range.
3. Optional: Highlight the row representing the device to be modified.
4. Click on the button **Set IP** from the top bar menu.
5. Indicate the serial number of the Ewon® Cosy+ that you want to modify.
   - If you went through step #3, the serial number is provided automatically.
6. Click **Next**.
7. Enter the <**new IP address**> and its <**subnet mask**>.
   - By clicking **Next**, eBuddy sends the commands to the Ewon® Cosy+ to change its IP address and to reboot.
8. Once the reboot completes, you can access the Ewon® Cosy+ using its new LAN IP address.

2. Talk2M Account Configuration

Talk2M offers a secured and easy way to set up a remote connection over the Internet.

To allow the remote access, you need to link the Ewon® Cosy+ to the Talk2M infrastructure, more specifically to a Talk2M account.

To configure the Talk2M account:

1. Launch eCatcher and log into your Talk2M account.
   a. To download and install eCatcher, please refer to eCatcher (page 3).
   b. In case you do not have a Talk2M account yet, click on **Create a Free+ Account** and follow the prompts on the screen. Once you have created the Talk2M account, an email will be sent with the activation link and instructions.
2. Click on the icon **+Add** to add the Ewon® Cosy+ to your Talk2M account.
3. Follow the screen prompts.
   - Be aware that some options require the full telephone number, country code included
4. Copy the **<Activation Key>** to the clipboard in the last step of the wizard. You will need it later during the Talk2M wizard of the Ewon® Cosy+ configuration.

The Ewon® Cosy+ is now successfully listed in the **<Ewon list>** of eCatcher.

3. Access the Web Configuration Interface

The configuration of the Ewon® Cosy+ can be done using its embedded web interface.

As your computer is connected to a LAN port of the Ewon® Cosy+, open an Internet browser and enter the LAN IP address of the Ewon® Cosy+ in to the address field.

If the computer is not in the same network address range as the Ewon® Cosy+, its web pages can be reached using the EZ DHCP feature of the eBuddy utility. For more information, refer to. eBuddy from the Related Documents (page 1).

Before beginning the configuration of the Ewon® Cosy+, authentication is required.

The default login and password are both **adm**.

At first boot or after a reset level 2 of the Ewon® Cosy+, and after successfully logging in, a prompt will appear to set the interface language.

A second prompt will ask you to change the **adm** default password.

3.1. Language Selection

As you log in to the Ewon® Cosy+ web interface, a window prompts and asks for the language of the interface: **English**, **Spanish**, **French**, **German** or **Italian**.

The language selection is also requested after a reset level 2 operation. A reset level 2 is a factory reset of the Ewon® Cosy+.

You can change the language of your Ewon® Cosy+ by browsing to Setup ► **System** ► **Main** ► **General** ► **Language**. The language modification induces a reboot of the Ewon® Cosy+.

3.2. Password Modification

As long as the password of the **adm** user remains **adm** (e.g.: on very first login or after a reset level 2), the Ewon® Cosy+ will ask you to change this password.

Figure A.1. **Password modification**

If the password is no longer **adm** but you need to change the password, you can do so in the *System Wizard*. Please refer to System Wizard (page 30).

Password Policy

A new password must meet the following requirements:

- minimum length: 12 characters;
- maximum length: 35 characters;
- only characters from the latin-1 set (ISO-8859-1);
- respect 3 of the following conditions:
  - at least one lowercase character,
  - at least one uppercase character,
  - at least one digit,
  - at least one special character.

4. Configuration through the Quick Launch Wizard

After you selected the interface language and change the **adm** default password., the Ewon® Cosy+ will propose a configuration wizard which leads to a quick configuration of the system and communication settings.

On later connections, the configuration wizard is accessible through the *Wizards* button in the upper right corner.

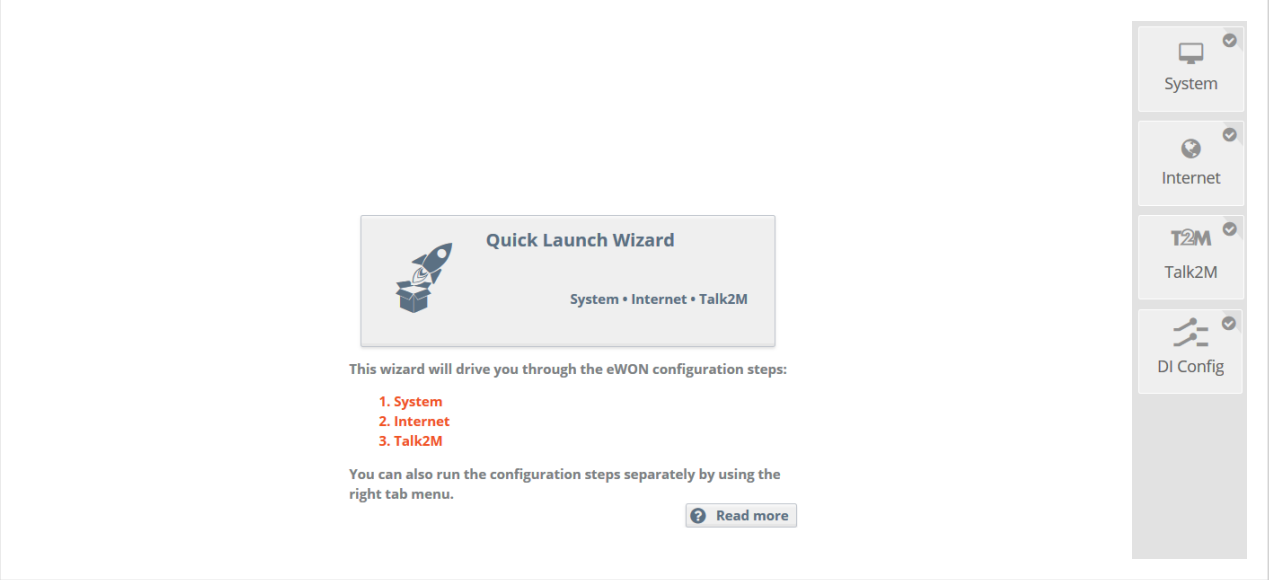


Figure A.2. Quick Launch Wizard Button

The Quick Launch Wizard will guide you through the different setup wizards to configure your Ewon® Cosy+ for remote connection trough Talk2M:

- The ***System Wizard*** configures basic system settings such as the date & time and the default username & password.
- The ***Internet Wizard*** configures the WAN communication settings.
- The ***Talk2M Wizard*** establish a VPN between the Ewon® Cosy+ and the Talk2M infrastructure.

4.1. System Wizard

The *System Wizard* configures basic system settings.

On the first screen of the *System Wizard*, enter the **Ewon name**.

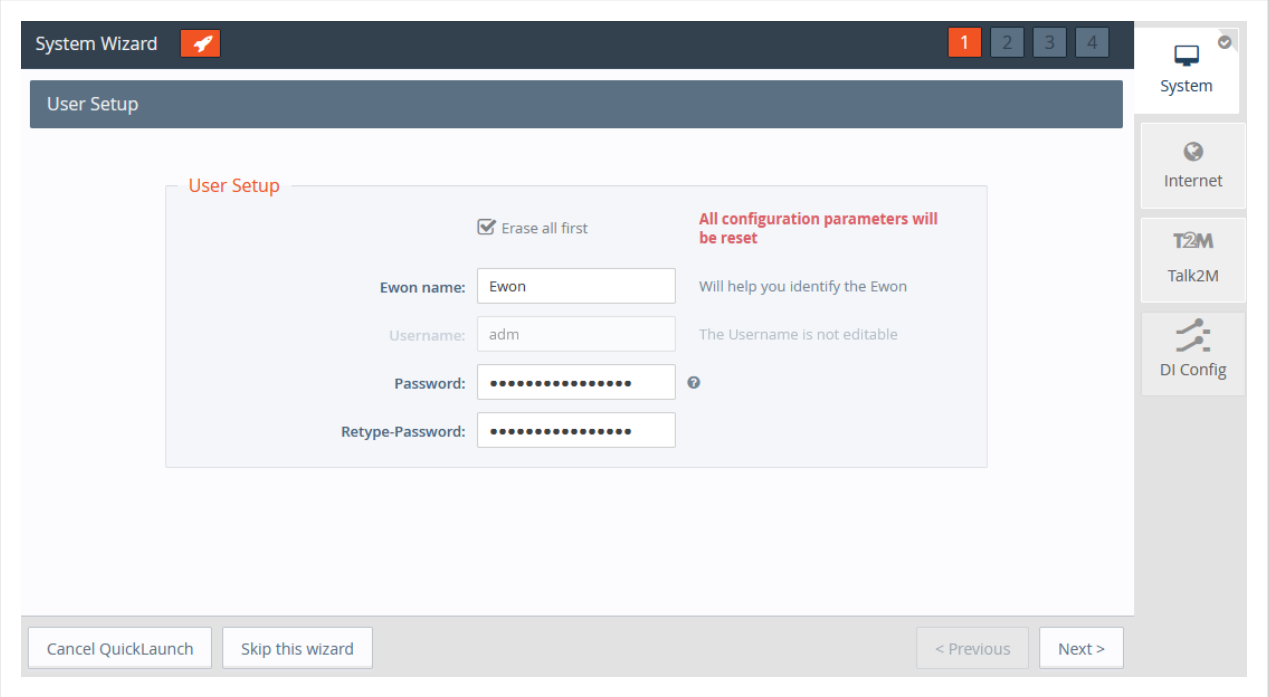


Figure A.3. System Wizard User Setup

NOTICE
As you changed the **adm** password (refer to Password Modification (page 28)), there is no need to change it again.

On the second screen of the *System Wizard*:

- Configure the accurate **<date and time>** settings. For Talk2M communication, it is imperative that the date of the Ewon® Cosy+ is correct.
- Configure the **<Timezone>** settings:
  – Click either on the arrow or the map icon.
- By default, the field is set to **ntp.talk2m.com** which is the best option for Ewon® Cosy+ connected to Talk2M. However, you have the possibility to set the URL of the remote **<NTP server>**. This field is shown only if **Update clock via NTP** is selected.
- The **<Time interval>** used to update the clock. Default value is 1440 minutes (= 1 day). This field is shown only if **Update clock via NTP** is selected.

Click **Next** to proceed to the next screen.

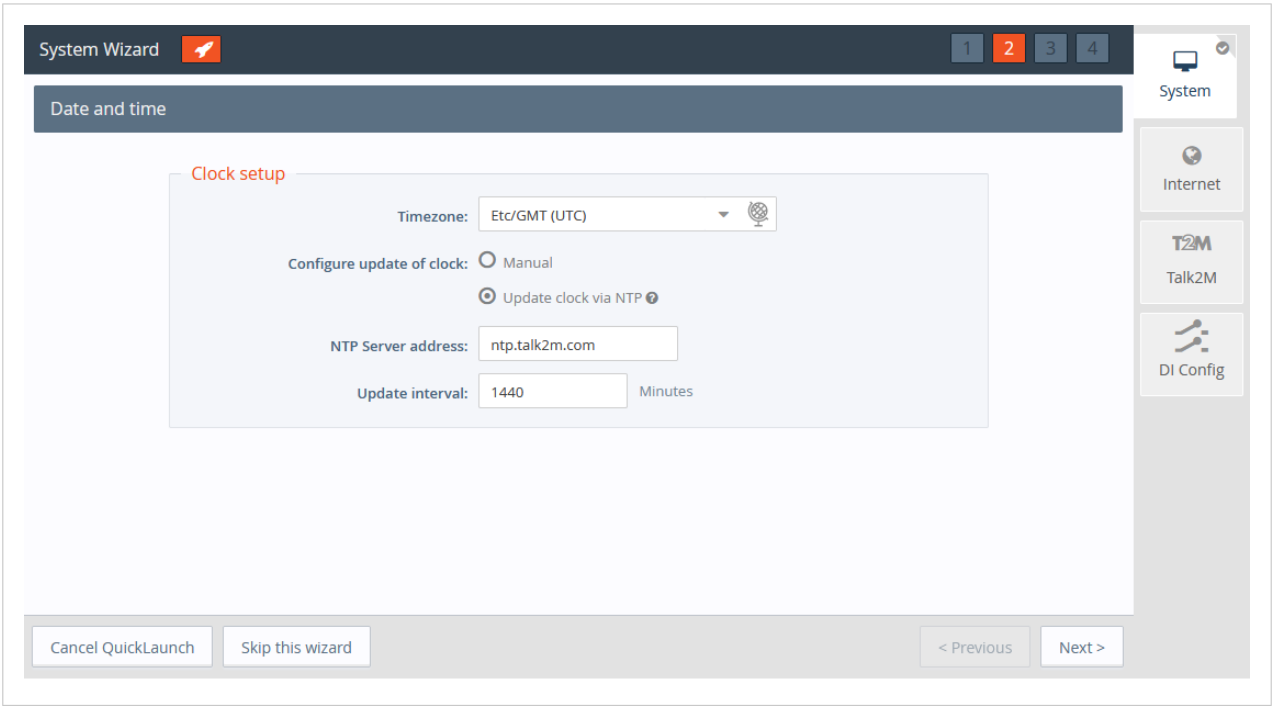


Figure A.4. System Wizard Date and Time

The third screen of the *System Wizard* shows the standard attribution of the four ports Ethernet switch.

The attribution of a port can be easily recognized by its LED color:

- Orange for a WAN port.
- Green for a LAN port.

Figure A.5. System Wizard LAN/WAN Configuration

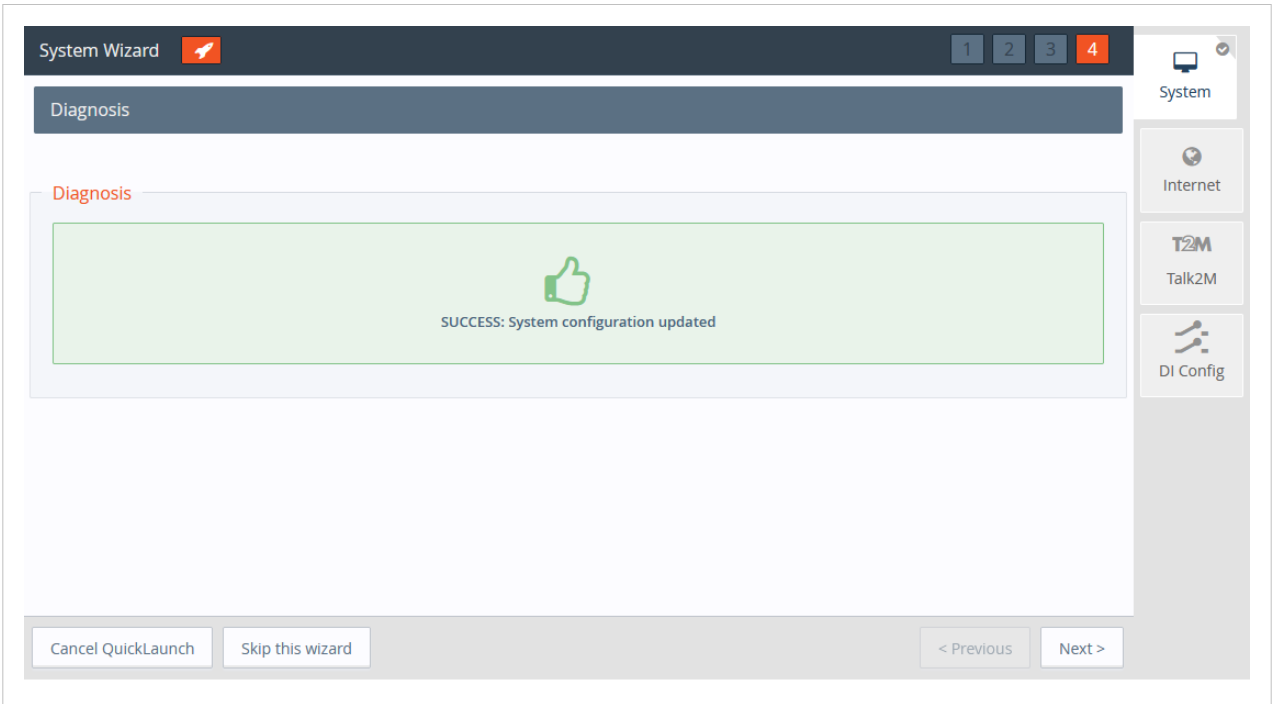


Figure A.6. System Wizard Diagnosis

4.2. Internet Wizard

The *Internet Wizard* configures the Internet settings for the Ewon® Cosy+. The **<Interface>** field allows the selection of the WAN interface used for the Internet connection:

- Ethernet WAN connection

Ethernet WAN Configuration

1. Select the *Ethernet Internet* connection.

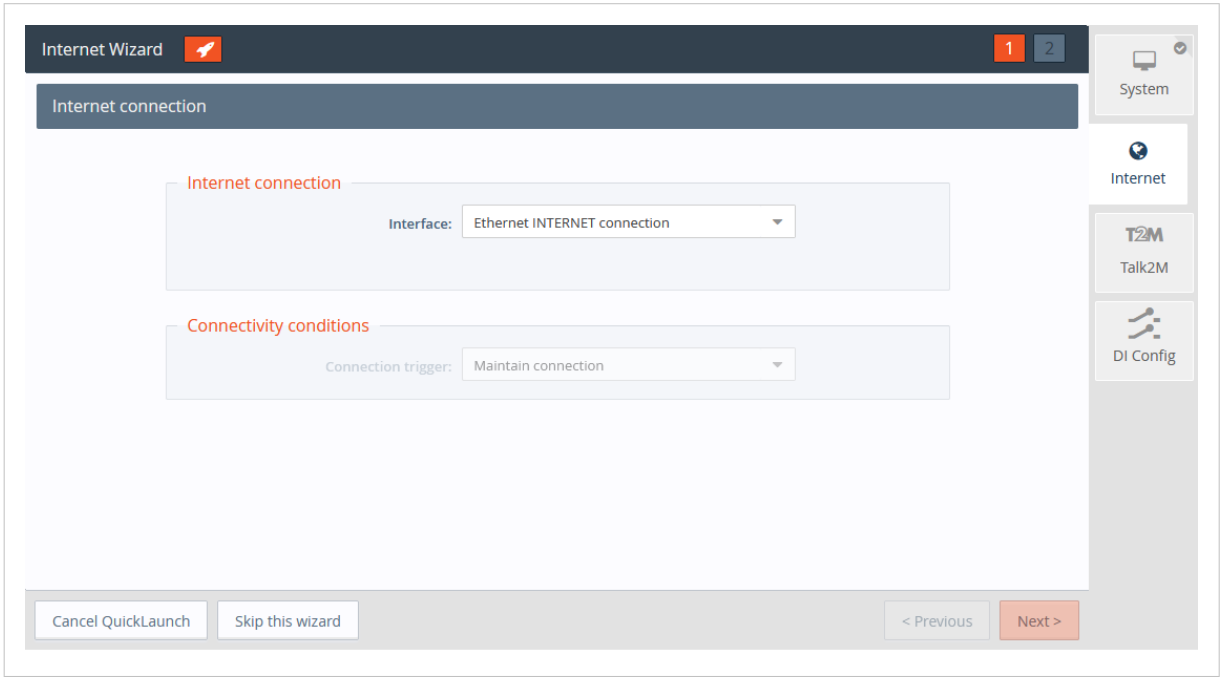


Figure A.7. Internet Wizard Connection Setup

2. Click **Next** to continue the WAN interface configuration.
3. Select the appropriate method how the Ewon® Cosy+ is supposed to receive its IP address, according to the network configuration: **Static**, **BootP** or **DHCP**.
   Select **DHCP** from the dropdown to receive an IP automatically from the LAN network.

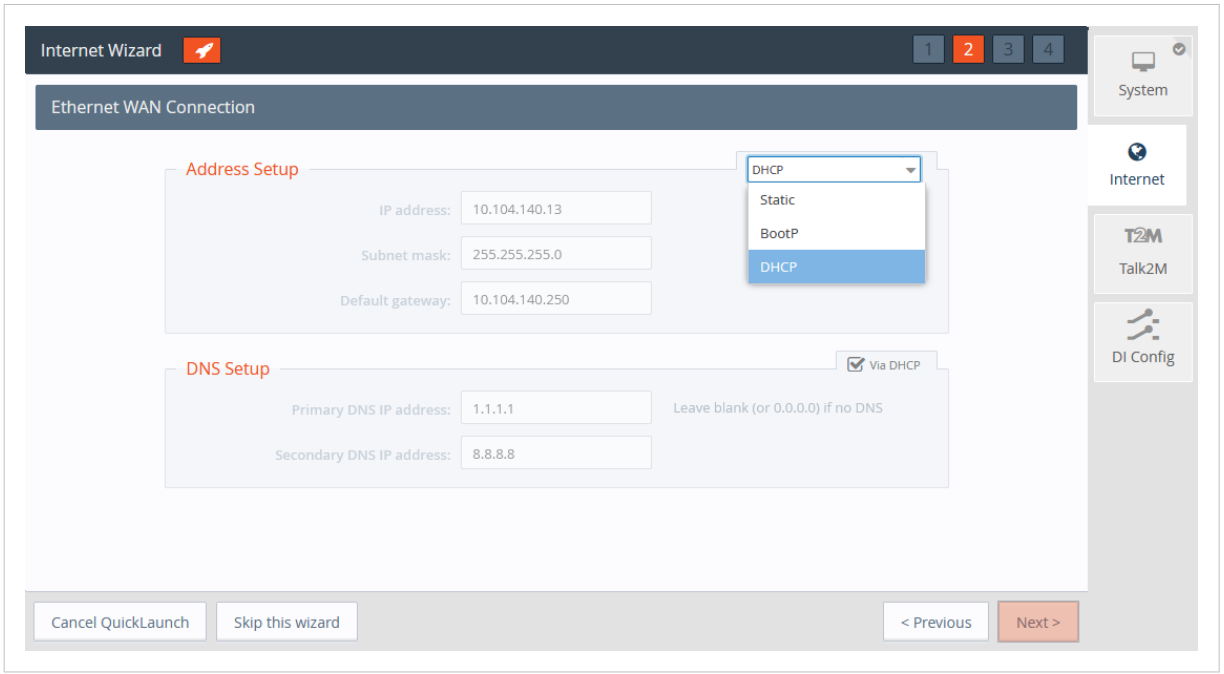


Figure A.8. Internet Wizard Ethernet WAN Connection Setup

4. Click **Next** to proceed to the next screen.

5. The *Internet connection* test is enabled by default, it allows the Ewon® Cosy+ to verify the Internet connection.
   Uncheck this option if this network uses a proxy server or if port 80 is closed for outbound connections.

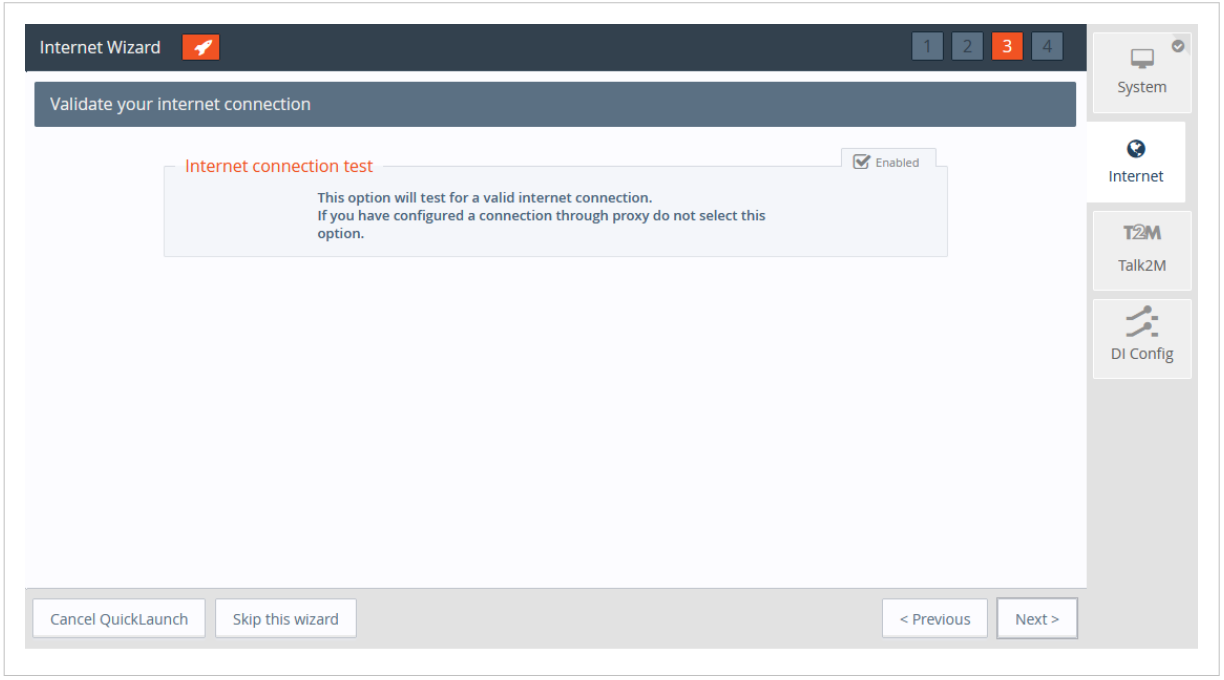


Figure A.9. Internet Wizard Validation

6. Click **Next** to apply the configuration changes.
   - Once the wizard completes successfully, the Ewon® Cosy+ is connected to the primary WAN network.

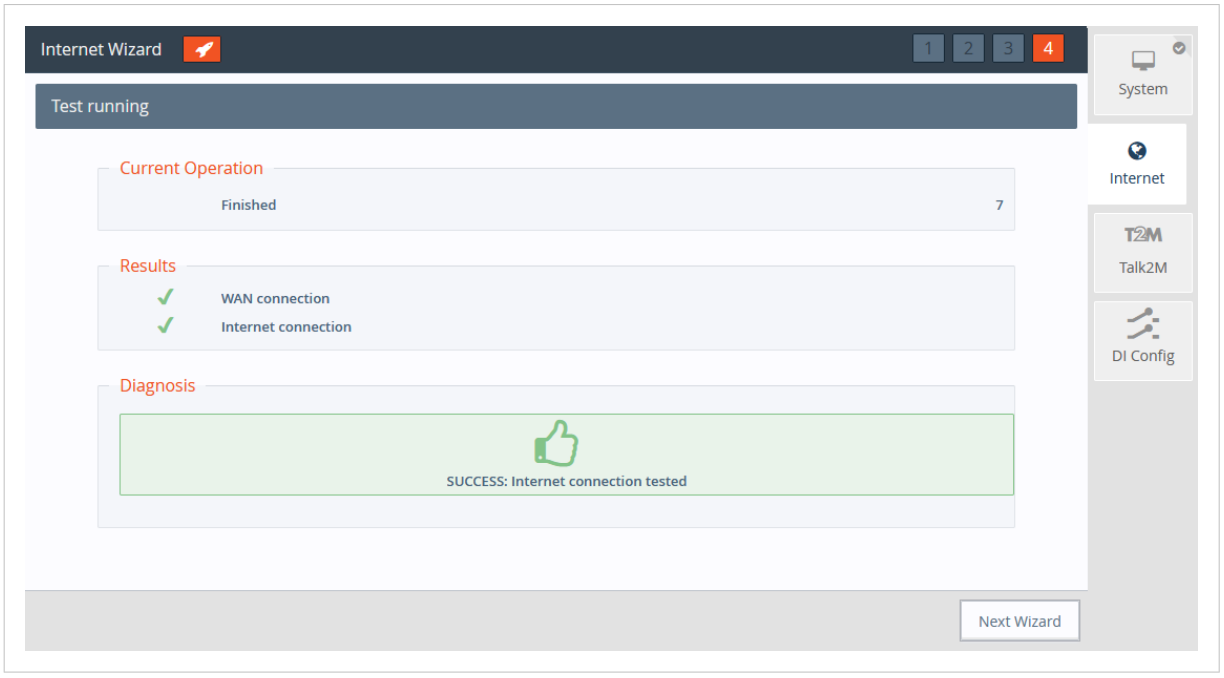


Figure A.10. Internet Wizard Test

4.3. Talk2M Wizard

The *Talk2M Wizard*, configures the VPN connection between the Ewon® Cosy+ and your Talk2M account on the Talk2M server.

- On the first screen of the *Talk2M Wizard*, select *Register with Activation Key* option
- Paste the Activation Key you copied from Talk2M Account Configuration (page 27).

Click **Next** to move forward to the next screen.

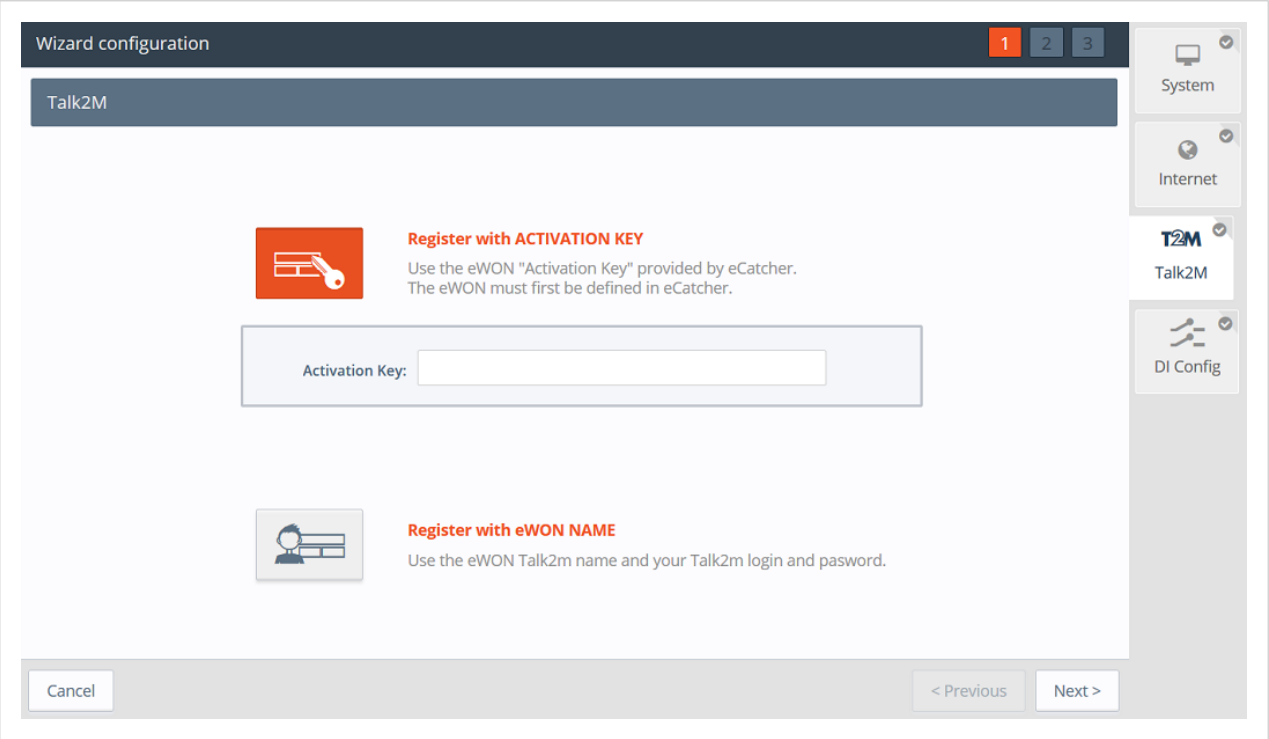


Figure A.11. Talk2M Wizard Activation Key

Alternately, it is possible to register with the Ewon Name option:

- Click on *Register with Ewon Name*
- Enter the Talk2M name of the Ewon® Cosy+, and a valid Talk2M account user credentials.

Click *Next* to move forward to the following screen.

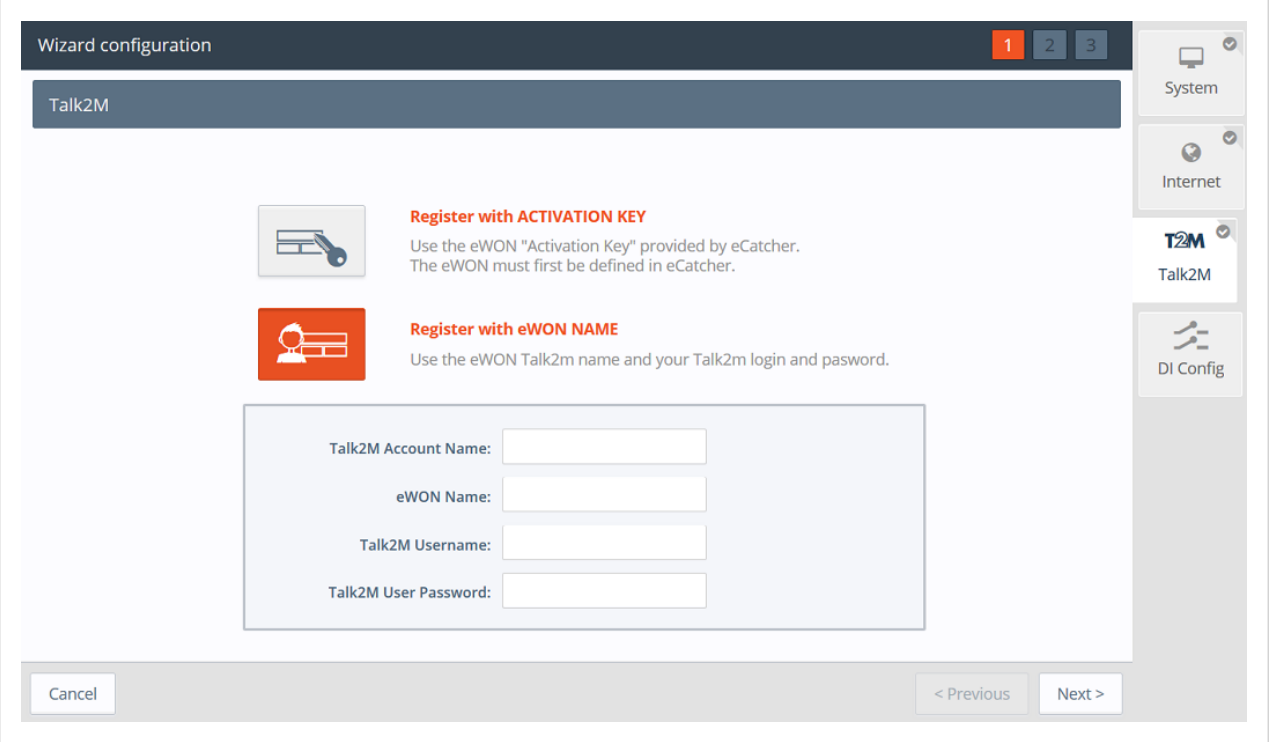


Figure A.12. Talk2M Wizard Registration Name

If the network used for Internet access apply a proxy server:

- Select the appropriate authentication method: **Proxy with basic authentication, Proxy with NTLM authentication, Proxy without authentication**.
- Enter the appropriate information for the proxy server

Click **Next** to move forward to the next screen.

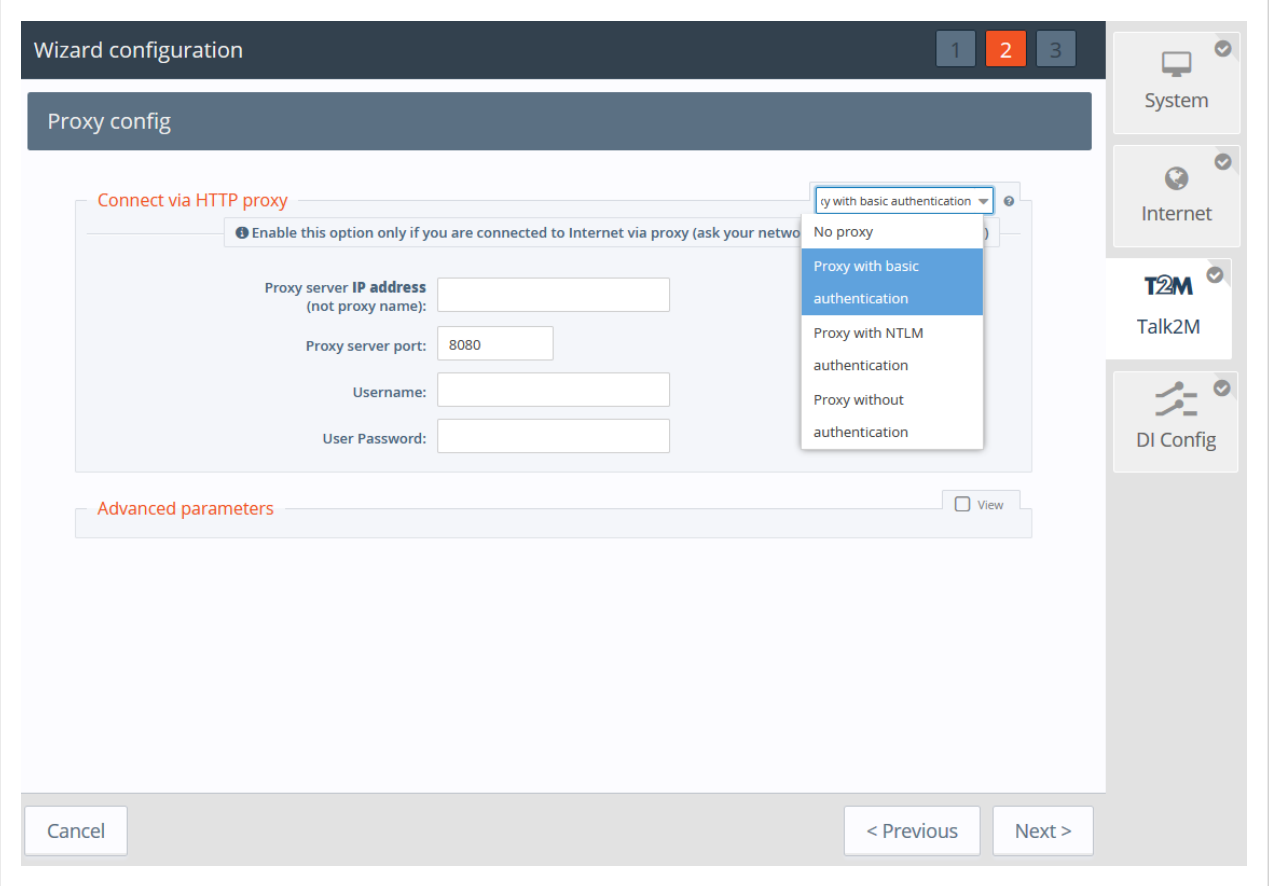


Figure A.13. Talk2M Wizard Proxy Configuration

This Wizard connects to the Talk2M server and retrieve the VPN settings for the Ewon® Cosy+ linked to your account. The Wizard also check UDP and TCP connection to find the best suitable option for this eWON. If the wizard completes successfully, the Ewon® Cosy+ is now configured for Remote Access through Talk2M. If the wizard fails, the Diagnostic and Setup (page 26) section will give additional troubleshooting information.

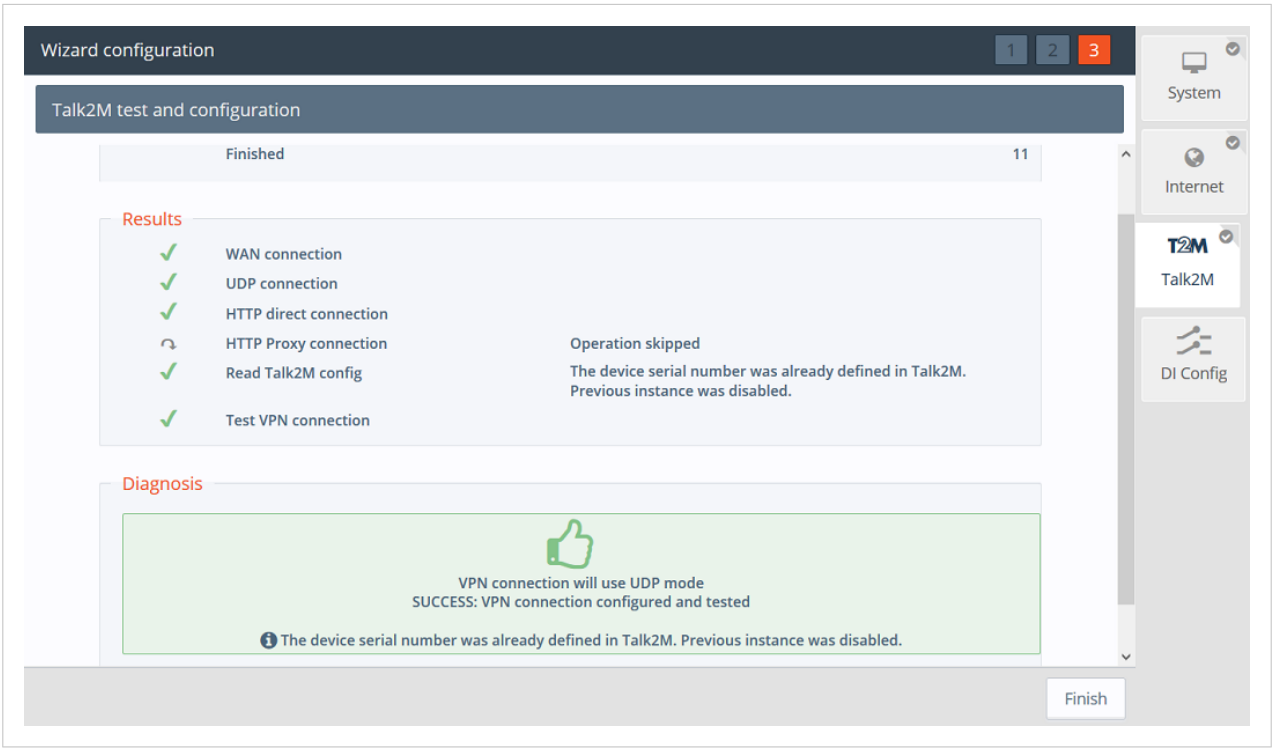


Figure A.14. Talk2M Wizard Validation

Operation Manual

Goodrive 200 Inverter

SHENZHEN INVT ELECTRIC CO., LTD.

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Preface

Thanks for choosing our products.

Goodrive200 series inverters are newly-designed by our company for controlling asynchronous AC inductance motors. Applying the most advanced speedless sensor vector control technology, DSP control system, and our product enhances its reliability to meet the adaptability to the environment, customized and industrialized design with more optimized functions, more flexible application and more stable performance.

The vector control performance of Goodrive200 series inverters is as outstanding as that of the leading sophisticated inverters on worldwide market. Its speed and torque control can be simultaneously, comparing with the other kinds, its function of anti-trip and strong adaptability to worse grid, temperature, humidity and dust make it meet the high performance requirement of the customer application.

Goodrive200 series inverters apply modularized design to meet the specific demand of customers, as well as the demand of the whole industry flexibly and follow the trend of industrial application to the inverters on the premise of meeting general need of the market. Powerful speed control, torque control, simple PLC, flexible input/output terminals, pulse frequency reference, traverse control can realize various complicate high-accuracy drives and provide integrative solution for the manufacturers of industrial devices, which contributes a lot to the cost reducing and improves reliability.

Goodrive200 series inverters can meet the demand of environmental protection which focuses on low noise and weakening electromagnetic interference in the application sites for the customers.

This manual provides installation and configuration, parameters setting, fault diagnoses and daily maintenance and relative precautions to customers. Please read this manual carefully before the installation to ensure a proper installation and operation and high performance of Goodrive200 series inverters.

If the product is ultimately used for military affairs or manufacture of weapon, it will be listed on the export control formulated by ***Foreign Trade Law of the People's Republic of China***. Rigorous review and necessary export formalities are needed when exported.

Our company reserves the right to update the information of our products.

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Safety Precautions 1

1.1 What this chapter contains

Please read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the inverter. If ignored, physical injury or death may occur, or damage may occur to the devices.

If any physical injury or death or damage to the devices occurs for ignoring to the safety precautions in the manual, our company will not be responsible for any damages and we are not legally bound in any manner.

1.2 Safety definition

Danger:	Serious physical injury or even death may occur if not follow relevant requirements
Warning:	Physical injury or damage to the devices may occur if not follow relevant requirements
Note:	Physical hurt may occur if not follow relevant requirements
Qualified electricians:	People working on the device should take part in professional electrical and safety training, receive the certification and be familiar with all steps and requirements of installing, commissioning, operating and maintaining the device to avoid any emergency.

1.3 Warning symbols

Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advice on how to avoid the danger. Following warning symbols are used in this manual:

Symbols	Name	Instruction	Abbreviation
Danger	Electrical Danger	Serious physical injury or even death may occur if not follow the relative requirements	
Warning	General danger	Physical injury or damage to the devices may occur if not follow the relative requirements	

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Symbols	Name	Instruction	Abbreviation
Do not	Electrostatic discharge	Damage to the PCBA board may occur if not follow the relative requirements	
Hot sides	Hot sides	Sides of the device may become hot. Do not touch.	
Note	Note	Physical hurt may occur if not follow the relative requirements	Note

1.4 Safety guidelines

✧Only qualified electricians are allowed to operate on the inverter.

✧Do not carry out any wiring and inspection or changing components when the power supply is applied. Ensure all input power supply is disconnected before wiring and checking and always wait for at least the time designated on the inverter or until the DC bus voltage is less than 36V. Below is the table of the waiting time:

Inverter model	Minimum waiting time
380V 1.5kW-110kW	5 minutes
380V 132 kW -315 kW	15 minutes
380V above 350 kW	25 minutes

✧Do not refit the inverter unauthorized; otherwise fire, electric shock or other injury may occur.

✧The base of the heat sink may become hot during running. Do not touch to avoid hurt.

✧The electrical parts and components inside the inverter are electrostatic. Take measurements to avoid electrostatic discharge during relevant operation.

1.4.1 Delivery and installation

✧ Please install the inverter on fire-retardant material and keep the inverter away from combustible materials.

✧ Connect the braking optional parts (braking resistors, braking units or feedback units) according to the wiring diagram.

✧ Do not operate on the inverter if there is any damage or components loss to

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	the inverter. ✧ Do not touch the inverter with wet items or body, otherwise electric shock may occur.

Note:

- ✧ Select appropriate moving and installing tools to ensure a safe and normal running of the inverter and avoid physical injury or death. For physical safety, the erector should take some mechanical protective measurements, such as wearing exposure shoes and working uniforms.
- ✧ Ensure to avoid physical shock or vibration during delivery and installation.
- ✧ Do not carry the inverter by its cover. The cover may fall off.
- ✧ Install away from children and other public places.
- ✧ The inverter cannot meet the requirements of low voltage protection in IEC61800-5-1 if the sea level of installation site is above 2000m.
- ✧ Please use the inverter on appropriate condition (See chapter ***Installation Environment***).
- ✧ Don't allow screws, cables and other conductive items to fall inside the inverter.
- ✧ The leakage current of the inverter may be above 3.5mA during operation. Ground with proper techniques and ensure the grounding resistor is less than 10Ω. The conductivity of PE grounding conductor is the same as that of the phase conductor (with the same cross sectional area).
- ✧ R, S and T are the input terminals of the power supply, while U, V and W are the motor terminals. Please connect the input power cables and motor cables with proper techniques; otherwise the damage to the inverter may occur.

1.4.2 Commission and running

	✧ Disconnect all power supplies applied to the inverter before the terminal wiring and wait for at least the designated time after disconnecting the power supply. ✧ High voltage is present inside the inverter during running. Do not carry out any operation except for the keypad setting. ✧ The inverter may start up by itself when P01.21=1. Do not get close to the inverter and motor. ✧ The inverter can not be used as “Emergency-stop device”. ✧ The inverter can not be used to break the motor suddenly. A mechanical

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	braking device should be provided.

Note:

- ✧ Do not switch on or off the input power supply of the inverter frequently.
- ✧ For inverters that have been stored for a long time, check and fix the capacitance and try to run it again before utilization (see ***Maintenance and Hardware Fault Diagnose***).
- ✧ Cover the front board before running, otherwise electric shock may occur.

1.4.3 Maintenance and replacement of components

	✧ Only qualified electricians are allowed to perform the maintenance, inspection, and components replacement of the inverter. ✧ Disconnect all power supplies to the inverter before the terminal wiring. Wait for at least the time designated on the inverter after disconnection. ✧ Take measures to avoid screws, cables and other conductive matters to fall into the inverter during maintenance and component replacement.

Note:

- ✧ Please select proper torque to tighten screws.
- ✧ Keep the inverter, parts and components away from combustible materials during maintenance and component replacement.
- ✧ Do not carry out any isolation and pressure test on the inverter and do not measure the control circuit of the inverter by megameter.
- ✧ Carry out a sound anti-electrostatic protection to the inverter and its internal components during maintenance and component replacement.

1.4.4 What to do after scrapping

	✧ There are heavy metals in the inverter. Deal with it as industrial effluent.

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Quick Start-up 2

2.1 What this chapter contains

This chapter mainly describes the basic guidelines during the installation and commission procedures on the inverter, which you may follow to install and commission the inverter quickly.

2.2 Unpacking inspection

Check as followings after receiving products:

1. Check that there are no damage and humidification to the package. If not, please contact with local agents or INVT offices.
2. Check the information on the type designation label on the outside of the package to verify that the drive is of the correct type. If not, please contact with local dealers or INVT offices.
3. Check that there are no signs of water in the package and no signs of damage or breach to the inverter. If not, please contact with local dealers or INVT offices.
4. Check the information on the type designation label on the outside of the package to verify that the name plate is of the correct type. If not, please contact with local dealers or INVT offices.
5. Check to ensure the accessories (including user's manual, control keypad and extension card) inside the device is complete. If not, please contact with local dealers or INVT offices.

2.3 Application confirmation

Check the machine before beginning to use the inverter:

1. Check the load type to verify that there is no overload of the inverter during work and check that whether the drive needs to modify the power degree.
2. Check that the actual current of the motor is less than the rated current of the inverter.
3. Check that the control accuracy of the load is the same of the inverter.
4. Check that the incoming supply voltage is correspondent to the rated voltage of the inverter.

2.4 Environment

Check as followings before the actual installation and usage:

1. Check that the ambient temperature of the inverter is below 40℃. If exceeds, derate 1%

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for every additional 1℃. Additionally, the inverter can not be used if the ambient temperature is above 50℃. **Note:** for the cabinet inverter, the ambient temperature means the air temperature inside the cabinet.
2. Check that the ambient temperature of the inverter in actual usage is above -10℃. If not, add heating facilities. **Note:** for the cabinet inverter, the ambient temperature means the air temperature inside the cabinet.
3. Check that the altitude of the actual usage site is below 1000m. If exceeds, derate1% for every additional 100m.
4. Check that the humidity of the actual usage site is below 90% and condensation is not allowed. If not, add additional protection inverters.
5. Check that the actual usage site is away from direct sunlight and foreign objects can not enter the inverter. If not, add additional protective measures.
6. Check that there is no conductive dust or flammable gas in the actual usage site. If not, add additional protection to inverters.

2.5 Installation confirmation

Check as followings after the installation:

1. Check that the input and output cables meet the need of actual load.
2. Check that the accessories of the inverter are correctly and properly installed. The installation cables should meet the needs of every component (including reactors, input filters, output reactors, output filters, DC reactors, braking units and braking resistors).
3. Check that the inverter is installed on non-flammable materials and the calorific accessories (reactors and braking resistors) are away from flammable materials.
4. Check that all control cables and power cables are run separately and the routation complies with EMC requirement.
5. Check that all grounding systems are properly grounded according to the requirements of the inverter.
6. Check that the free space during installation is sufficient according to the instructions in user's manual.
7. Check that the installation conforms to the instructions in user's manual. The drive must be installed in an upright position.
8. Check that the external connection terminals are tightly fastened and the torque is

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appropriate.
9. Check that there are no screws, cables and other conductive items left in the inverter. If not, get them out.

2.6 Basic commission

Complete the basic commissioning as followings before actual utilization:

1. Select the motor type, set correct motor parameters and select control mode of the inverter according to the actual motor parameters.
2. Autotune. If possible, de-coupled from the motor load to start dynamic autotune. Or if not, static autotune is available.
3. Adjust the ACC/DEC time according to the actual running of the load.
4. Commission the device via jogging and check that the rotation direction is as required. If not, change the rotation direction by changing the wiring of motor.
5. Set all control parameters and then operate.

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Product Overview 3

3.1 What this chapter contains

The chapter briefly describes the operation principle, product characteristics, layout, name plate and type designation information.

3.2 Basic principles

Goodrive200 series inverters are wall, flange and mountable devices for controlling asynchronous AC inductance motors.

The diagram below shows the main circuit diagram of the inverter. The rectifier converts three-phase AC voltage to DC voltage. The capacitor bank of the intermediate circuit stabilizes the DC voltage. The converter transforms the DC voltage back to AC voltage for the AC motor. The brake pipe connects the external braking resistor to the intermediate DC circuit to consume the feedback energy when the voltage in the circuit exceeds its maximum limit.

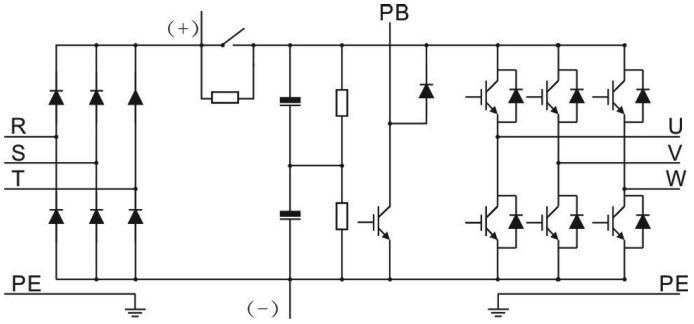

Diagram 3-1 The main circuit diagram（≤30kW)

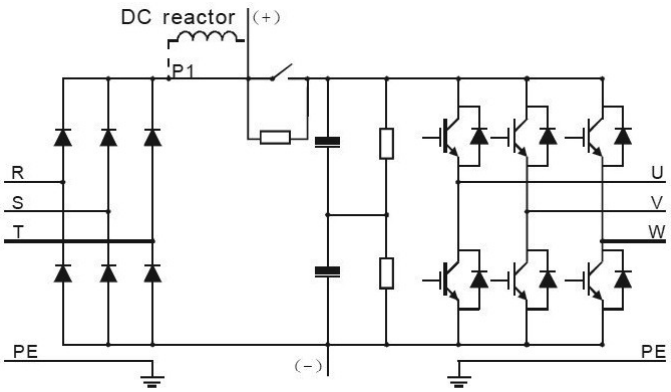

Diagram 3-2 The main circuit diagram（≥37kW)

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Note:

1. The inverter above **37kW** (including **37kW**) supports external DC reactor which is an optional part. Before connecting, it is necessary to remove the copper row between **P1** and **（+）.**

2. The inverter below **30kW** (including **30kW**) supports external braking resistor; the inverter above **37kW** (including **37kW**) supports external braking units. Both the braking unit and the braking resistor are optional parts.

3.3 Product specification

Function		Specification
Input	Input voltage (**V**)	AC 3PH 220V(-15%)~240V(+10%) AC 3PH 380V(-15%)~440V(+10%) AC 3PH 520V(-15%)~690V(+10%)
	Input current (**A**)	Refer to *the rated value*
	Input frequency (**Hz**)	50Hz or 60Hz Allowed range: 47~63Hz
Output	Output voltage (**V**)	0~Input voltage
	Output current (**A**)	Refer to *the rated value*
	Output power (**kW**)	Refer to *the rated value*
	Output frequency (**Hz**)	0~400Hz
Technical control feature	Control mode	SVPWM, SVC
	Motor type	Asynchronous motor
	Speed ratio	Asynchronous motor 1:200 (SVC)
	Speed control accuracy	±0.2% (sensorless vector control)
	Speed fluctuation	± 0.3%(sensorless vector control)
	Torque response	<20ms(sensorless vector control)
	Torque control accuracy	10%(sensorless vector control)
	Starting torque	Asynchronous motor: 0.25Hz/150% (SVC)
	Overload capability	G type: 150% of rated current: 1 minute 180% of rated current: 10 seconds 200% of rated current: 1 second

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Function		Specification
Running control feature	Frequency setting	Digital setting, analog setting, pulse frequency setting, multi-step speed running setting, simple PLC setting, PID setting, MODBUS communication setting. Shift between the set combination and set channel.
	Auto voltage adjustment	Keep a stable voltage automatically when the grid voltage transients
	Fault protection	Provide over 30 fault protection functions: overcurrent, overvoltage, undervoltage, overheating, phase loss and overload, etc.
	Speed tracking	Restart the rotating motor smoothly Note: This function is available for the inverters of 4kW and above 4kW.
Peripheral interface	Terminal analog input resolution	≤ 20mV
	Terminal switch input resolution	≤ 2ms
	Analog input	2 channels (AI1, AI2) 0~10V/0~20mA and 1 channel (AI3) -10~10V
	Analog output	2 channels (AO1, AO2) 0~10V /0~20mA
	Digital input	8 channels common input, the Max. frequency: 1kHz, internal impedance: 3.3kΩ; 1 channel high speed input, the Max. frequency: 50kHz
	Digital output	1 channel high speed pulse output, the Max. frequency: 50kHz; 1 channel Y terminal open collector pole output
	Relay output	2 channels programmable relay output RO1A NO, RO1B NC, RO1C common terminal RO2A NO, RO2B NC, RO2C common terminal Contactor capability: 3A/AC250V,1A/DC30V
Others	Mountable method	Wall, flange and floor mountable

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Function		Specification
	Temperature of the running environment	-10~50℃, derate above 40℃
	Ingress protection	IP20
	Cooling	Air-cooling
	Braking unit	Built-in braking unit for inverters below 30kW (including 30kW) External braking unit for others
	EMC filter	Built-in C3 filter: meet the degree requirement of IEC61800-3 C3 External optional filter:meet the degree requirement of IEC61800-3 C2

3.4 Name plate

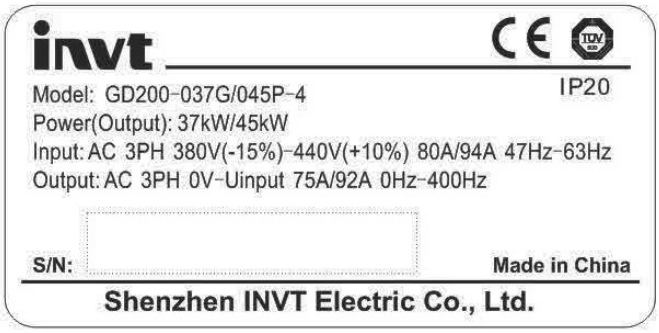

Fig 3-3 Name plate

Note: This is the example of the name plate for the standard products, and CE\TUV\IP20 will be marked according to the actual situations.

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3.5 Type designation key

The type designation contains information on the inverter. The user can find the type designation on the type designation label attached to the inverter or the simple name plate.

Fig 3-4 Product type

Key	Instructions	
A	GD200: abbreviation of Goodrive200	
B, D	3-digit code: output power. “R” means the decimal point; ”011”:11kW; “015”:15kW	
C, E	C	G:Constant torque load
	E	P:Variable torque load
F	Input voltage degree: 2: AC 3PH 220V(-15%)~240V(+10%) 4: AC 3PH 380V(-15%)~ 440V(+10%) 6: AC 3PH 520V(-15%)~690V(+10%)	

3.6 Rated specifications

Model	Constant torque			Variable torque		
	Output power (kW)	Input current (A)	Output current (A)	Output power (kW)	Input current (A)	Output current (A)
GD200-1R5G-4	1.5	5.0	3.7			
GD200-2R2G-4	2.2	5.8	5			
GD200-004G/5R5P-4	4	13.5	9.5	5.5	19.5	14
GD200-5R5G/7R5P-4	5.5	19.5	14	7.5	25	18.5
GD200-7R5G/011P-4	7.5	25	18.5	11	32	25
GD200-011G/015P-4	11	32	25	15	40	32
GD200-015G/018P-4	15	40	32	18.5	47	38
GD200-018G/022P-4	18.5	47	38	22	56	45
GD200-022G/030P-4	22	56	45	30	70	60
GD200-030G/037P-4	30	70	60	37	80	75

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Model	Constant torque			Variable torque		
	Output power (kW)	Input current (A)	Output current (A)	Output power (kW)	Input current (A)	Output current (A)
GD200-037G/045P-4	37	80	75	45	94	92
GD200-045G/055P-4	45	94	92	55	128	115
GD200-055G/075P-4	55	128	115	75	160	150
GD200-075G/090P-4	75	160	150	90	190	180
GD200-090G/110P-4	90	190	180	110	225	215
GD200-110G/132P-4	110	225	215	132	265	260
GD200-132G/160P-4	132	265	260	160	310	305
GD200-160G/185P-4	160	310	305	185	345	340
GD200-185G/200P-4	185	345	340	200	385	380
GD200-200G/220P-4	200	385	380	220	430	425
GD200-220G/250P-4	220	430	425	250	485	480
GD200-250G/280P-4	250	485	480	280	545	530
GD200-280G/315P-4	280	545	530	315	610	600
GD200-315G/350P-4	315	610	600	350	625	650
GD200-350G/400P-4	350	625	650	400	715	720
GD200-400G-4	400	715	720			
GD200-500G-4	500	890	860			

Note:

1. The input current of 1.5~315kW inverters is measured when the input voltage is 380V and no DC reactor and input/output reactor.
2. The input current of 350~500kW inverters is measured when the input voltage is 380V and the circuit is with input reactor.
3. The rated output current is defined as the output current when the output voltage is 380V.
4. In the allowable voltage range, the output power and current can not exceed the rated output power and current in any situation.

3.7 Structure diagram

Below is the layout figure of the inverter (take the inverter of 30kW as the example).

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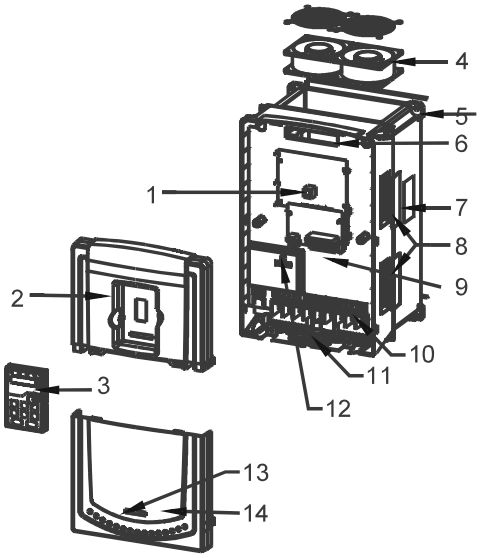

Fig 3-5 Product structure diagram

Serial No.	Name	Illustration
1	Keypad port	Connect the keypad
2	Upper cover	Protect the internal parts and components
3	Keypad	See ***Keypad Operation Procedure*** for detailed information
4	Cooling fan	See ***Maintenance and Hardware Fault Diagnose*** for detailed information
5	Wires port	Connect to the control board and the drive board
6	Name plate	See ***Product Overview*** for detailed information
7	Side cover	Optional part. The side cover will increase the protective degree of the inverter. The internal temperature of the inverter will increase, too, so it is necessary to derate the inverter at the same time
8	Control terminals	See ***Electric Installation*** for detailed information
9	Main circuit terminals	See ***Electric Installation*** for detailed information
10	Main circuit cable entry	Fix the main circuit cable
11	POWER light	Power indicator
12	Simple name plate	See ***Product Overview*** for detailed information
13	Lower cover	Protect the internal parts and components

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Installation Guidelines 4

4.1 What this chapter contains

The chapter describes the mechanical installation and electric installation.

	✧Only qualified electricians are allowed to carry out what described in this chapter. Please operate as the instructions in ***Safety Precautions***. Ignoring these may cause physical injury or death or damage to the devices. ✧Ensure the power supply of the inverter is disconnected during the operation. Wait for at least the time designated until the POWER indicator is off after the disconnection if the power supply is applied. It is recommended to use the multimeter to monitor that the DC bus voltage of the drive is under 36V. ✧The installation and design of the inverter should be complied with the requirement of the local laws and regulations in the installation site. If the installation infringes the requirement, our company will exempt from any responsibility. Additionally, if users do not comply with the suggestion, some damage beyond the assured maintenance range may occur.

4.2 Mechanical installation

4.2.1 Installation environment

The installation environment is important for a full performance and long-term stable functions of the inverter. Check the installation environment as followings:

Environment	Conditions
Installation site	Indoor
Environment temperature	-10~+50℃ If the ambient temperature of the inverter is above 40℃, derate 1% for every additional 1℃. It is not recommended to use the inverter if the ambient temperature is above 50℃. In order to improve the reliability of the device, do not use the inverter if the ambient temperature changes frequently. Please provide cooling fan or air conditioner to control the internal ambient temperature below the required one if the inverter is used in a close space such as in the control cabinet.

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Environment	Conditions
	When the temperature is too low, if the inverter needs to restart to run after a long stop, it is necessary to provide an external heating device to increase the internal temperature, otherwise damage to the devices may occur.
Humidity	RH≤90% No condensation is allowed. The maximum relative humility should be equal to or less than 60% in corrosive air.
Storage temperature	-30~+60℃
Running environment condition	The installation site of the inverter should: keep away from the electromagnetic radiation source; keep away from contaminative air, such as corrosive gas, oil mist and flammable gas; ensure foreign objects, such as metal power, dust, oil, water can not enter into the inverter(do not install the inverter on the flammable materials such as wood); keep away from direct sunlight, oil mist, steam and vibration environment.
Altitude	Below 1000m If the sea level is above 1000m, please derate 1% for every additional 100m.
Vibration	≤ 5.8m/s^2(0.6g)
Installation direction	The inverter should be installed on an upright position to ensure sufficient cooling effect.

Note:

- ◆ Goodrive200 series inverters should be installed in a clean and ventilated environment according to enclosure classification.
- ◆ Cooling air must be clean, free from corrosive materials and electrically conductive dust.

4.2.2 Installation direction

The inverter may be installed on the wall or in a cabinet.

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The inverter must be installed in an upright position. Check the installation site according to the requirements below. Refer to chapter ***Dimension Drawings*** in the appendix for frame details.

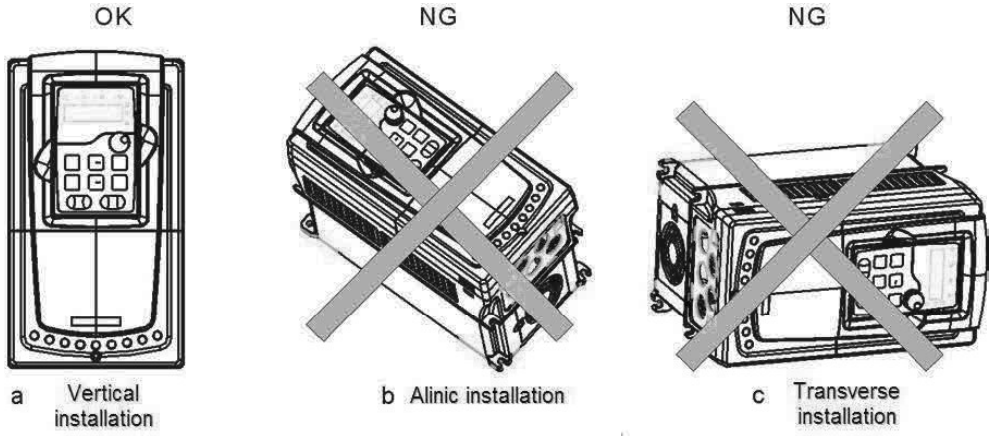

Fig 4-1 Installation direction of the inverter

4.2.3 Installation manner

The inverter can be installed in two different ways, depending on the frame size:

a) Wall mounting (for the inverter≤315kW)

b) Flange mounting (for the inverter≤200kW). Some need optional flange installation board.

c) Floor mounting (220kW≤the inverter≤500kW). Some need optional base.

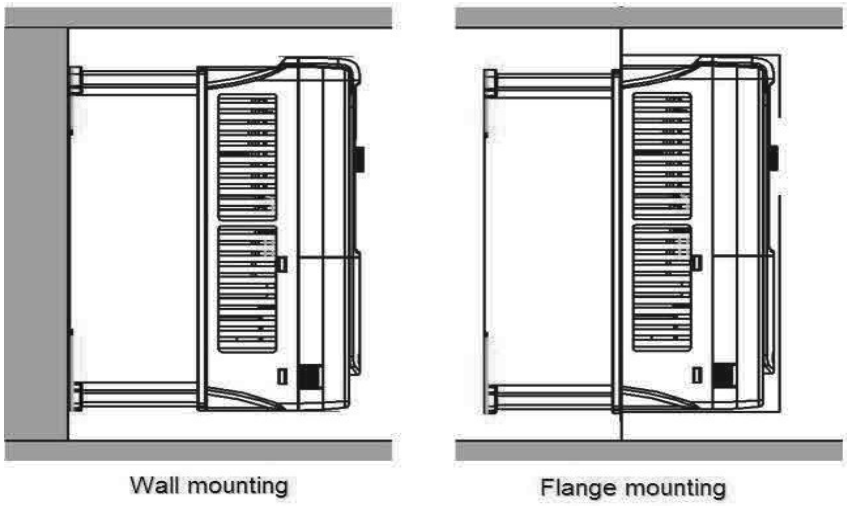

Fig 4-2 Installation manner

(1) Mark the hole location. The location of the holes is shown in the dimension drawings in the appendix.

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(2) Fix the screws or bolts to the marked locations.

(3) Position the drive onto the wall.

(4) Tighten the screws in the wall securely.

Note:

1. The flange installation bracket is needed in the flange installation of 1.5~30kW inverters, which the flange installation of 37~200kW inverters does not need the installation bracket.

2. 220~315kW inverters need optional base in the floor installation.

4.2.4 Single installation

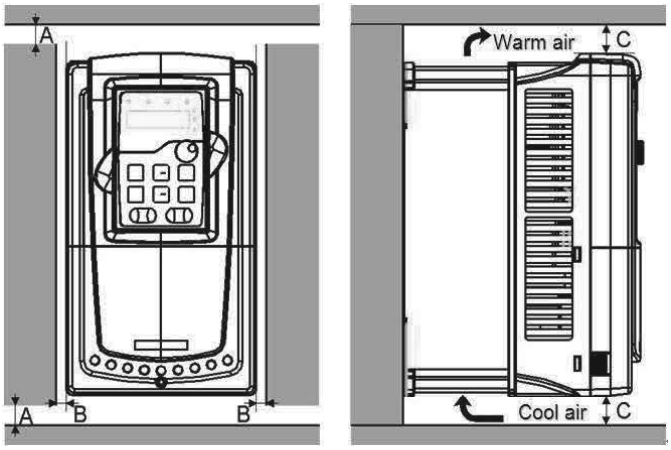

Fig 4-3 Single installation

Note: The minimum space of B and C is 100mm.

4.2.5 Multiple installations

Parallel installation

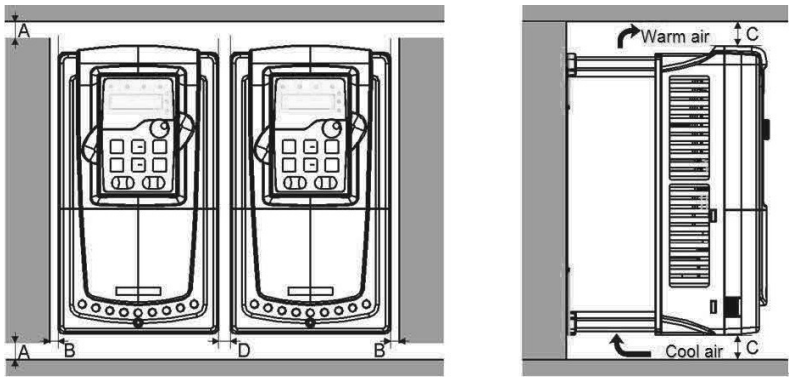

Fig 4-4 Parallel installation

Note:

◆ Before installing the different sizes inverters, please align their top position for the

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convenience of later maintenance.

◆ The minimum space of B, D and C is 100mm.

4.2.6 Vertical installation

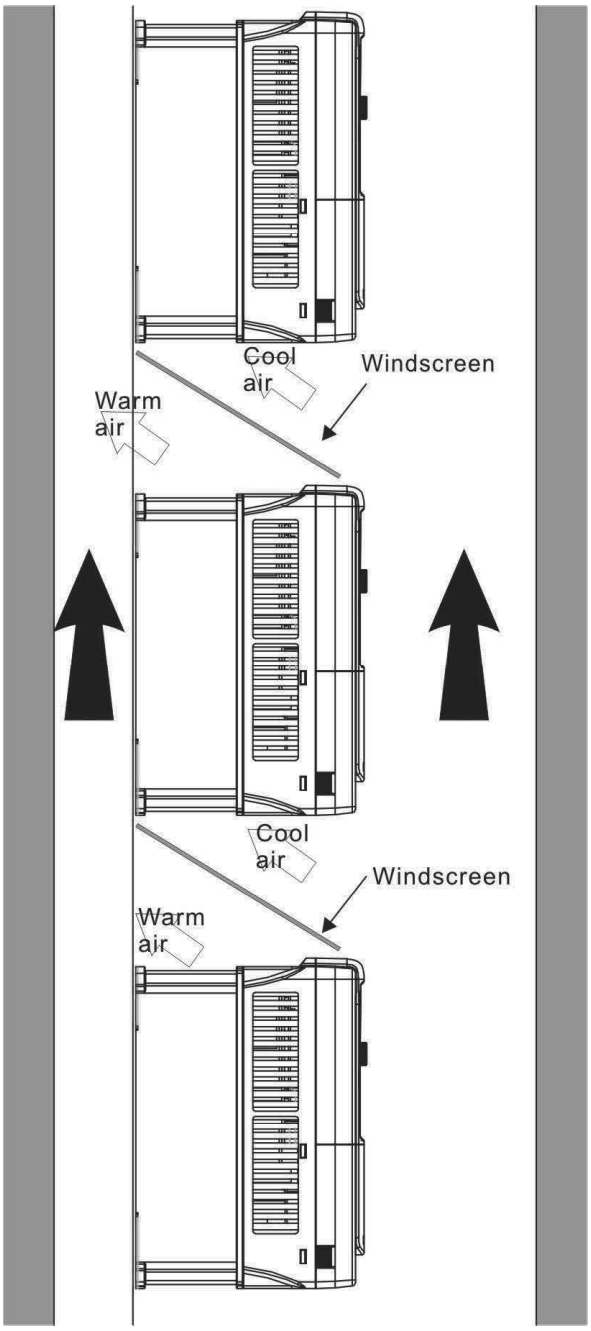

Fig 4-5 Vertical installation

Note: Windscreen should be added in vertical installation for avoiding mutual impact and insufficient cooling.

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4.2.7 Tilt installation

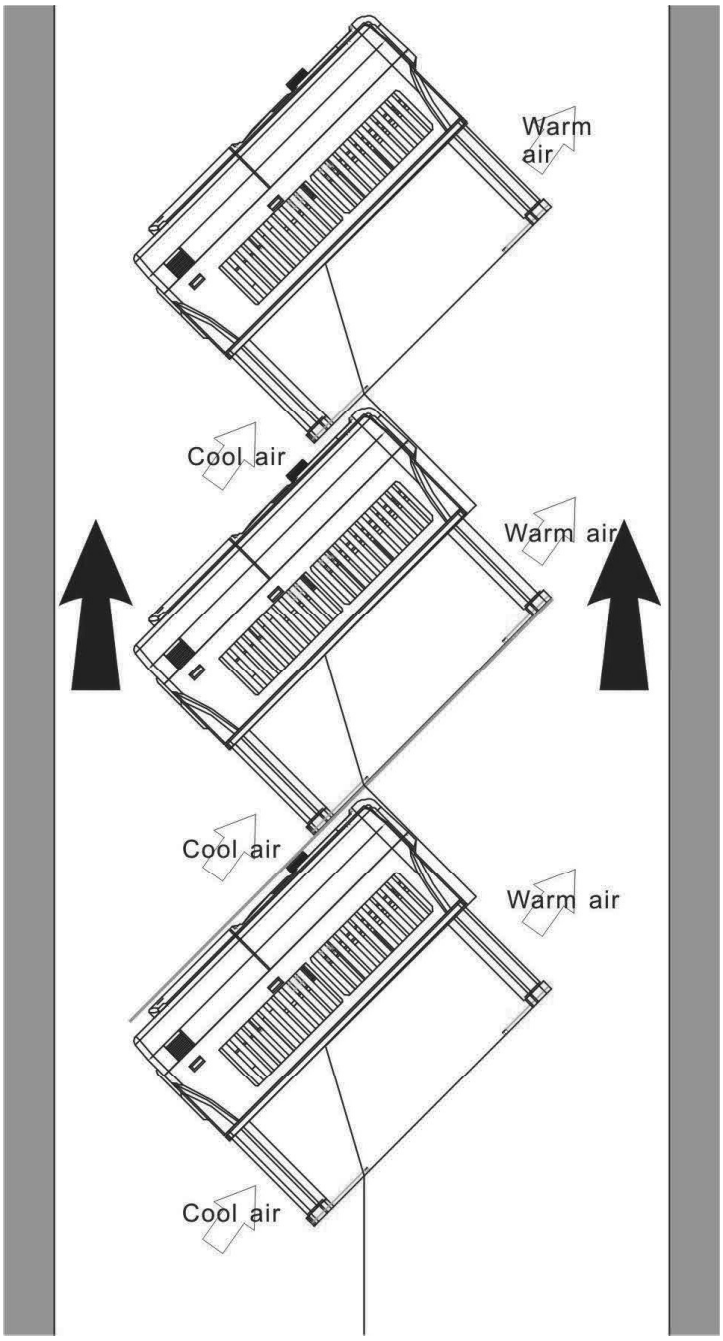

Fig 4-6 Tilt installation

Note: Ensure the separation of the wind input and output channels in tilt installation for avoiding mutual impact.

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4.3 Standard wiring

4.3.1 Wiring diagram of main circuit

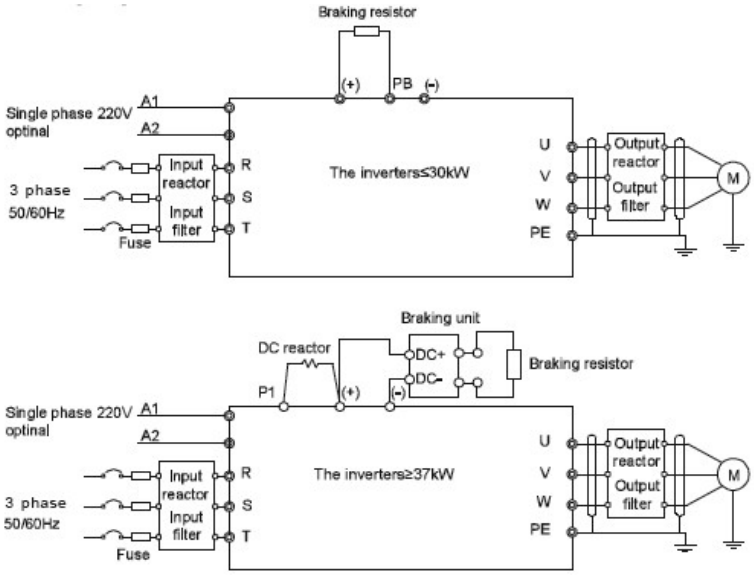

Fig 4-7 Wiring diagram of main circuit

Note:

- The fuse, DC reactor, braking unit, braking resistor, input reactor, input filter, output reactor, output filter are optional parts. Please refer to ***Peripheral Optional Parts*** for detailed information.
- **A1** and **A2** are optional parts.
- **P1** and **(+)** are short circuited in factory, if need to connect with the DC rector, please remove the contact tag between **P1** and **(+)**.
- Before connecting the braking resistor cable, remove the yellow labels of PB, (+), and (-) from the terminal blocks. Otherwise, poor connection may occur.

4.3.2 Terminals figure of main circuit

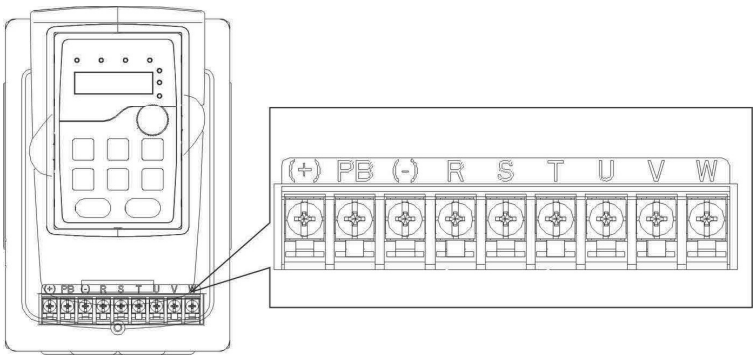

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Fig 4-8 1.5~2.2 kW terminals of main circuit

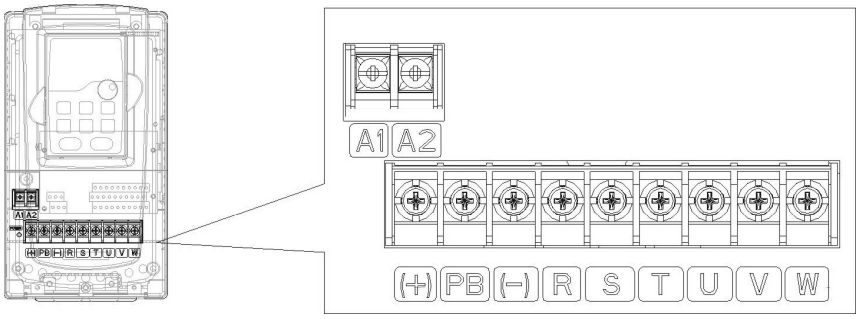

Fig 4-9 4~5.5 kW terminals of main circuit

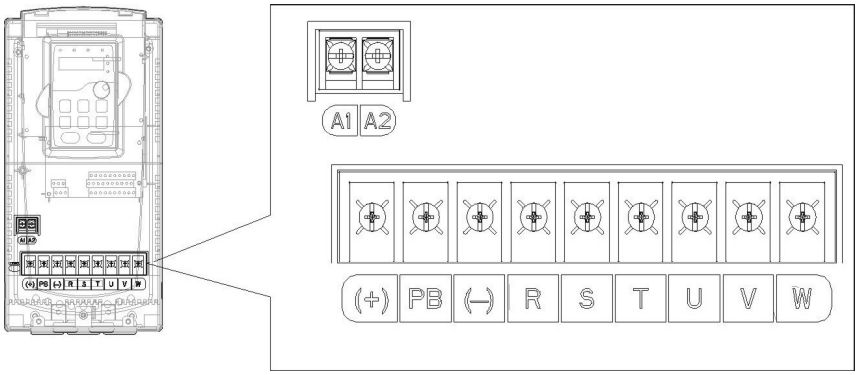

Fig 4-10 7.5~11kW terminals of main circuit

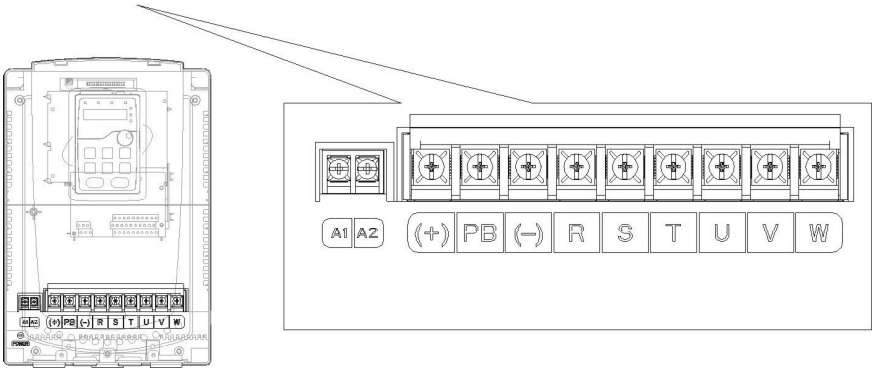

Fig 4-11 15~18kW terminals of main circuit

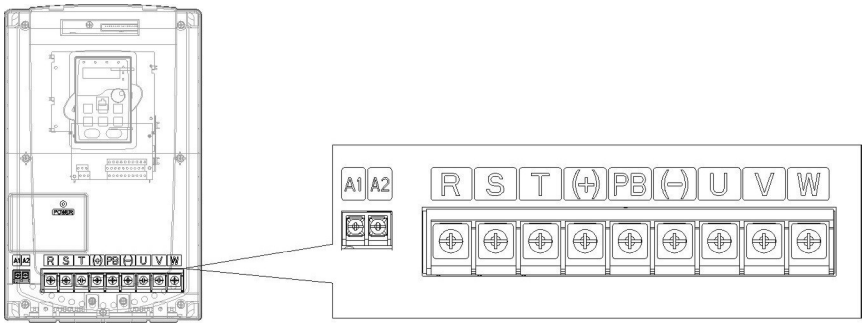

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Fig 4-12 22~30kW terminals of main circuit

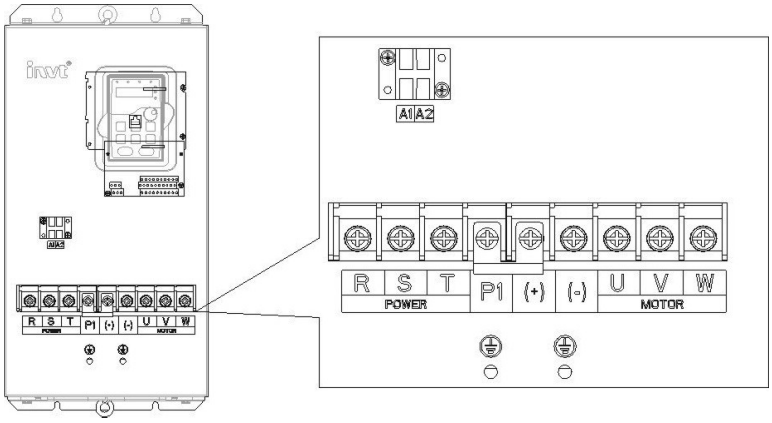

Fig 4-13 37~55 kW terminals of main circuit

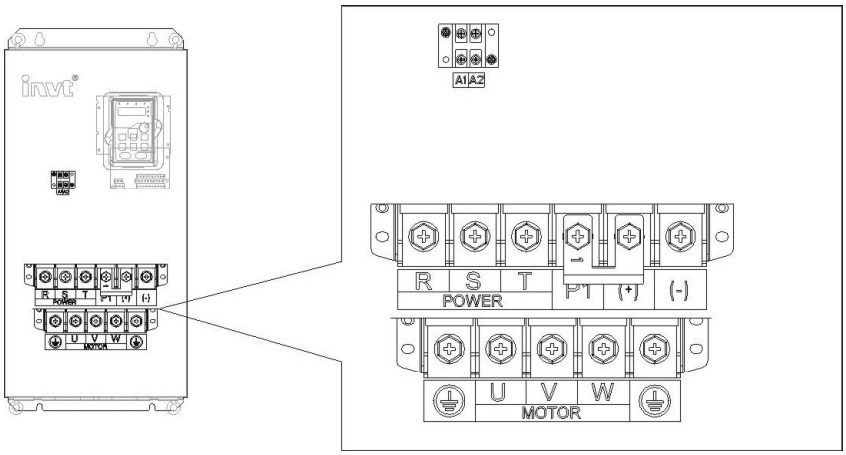

Fig 4-14 75~110kW terminals of main circuit

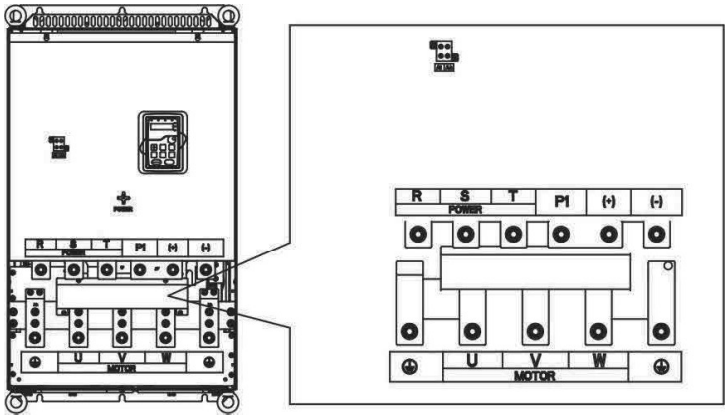

Fig 4-15 132~200kW terminals of main circuit

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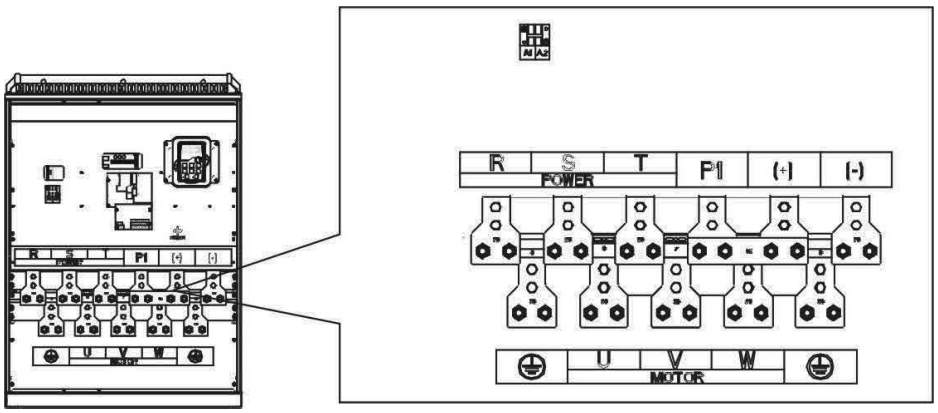

Fig 4-16 220~315kW terminals of main circuit

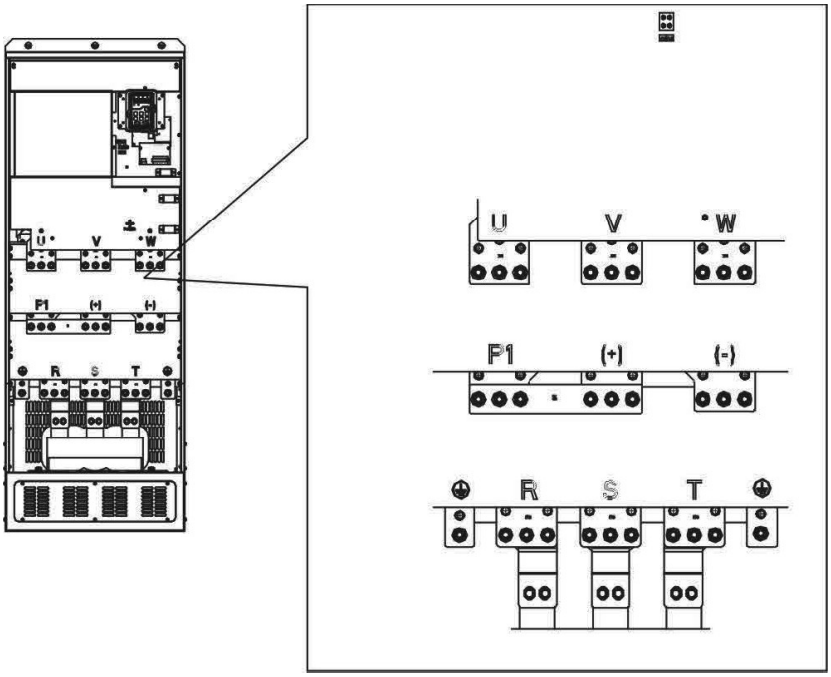

Fig 4-17 350~500kW terminals of main circuit

Terminal	Terminal name		Function
	≤30kW	≥37kW	
R, S, T	Power input of the main circuit		3-phase AC input terminals which are generally connected with the power supply.

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<table>
<tr><th rowspan="2">Terminal</th><th colspan="2">Terminal name</th><th rowspan="2">Function</th></tr>
<tr><th>≤30kW</th><th>≥37kW</th></tr>
<tr><td>U, V, W</td><td colspan="2">The inverter output</td><td>3-phase AC output terminals which are generally connected with the motor.</td></tr>
<tr><td>P1</td><td>This terminal is inexistent</td><td>DC reactor terminal 1</td><td rowspan="4">P1 and (+) are connected with the terminals of DC reactor.
(+) and (-) are connected with the terminals of braking unit.
PB and (+) are connected with the terminals of braking resistor.</td></tr>
<tr><td>(+)</td><td>Braking resistor 1</td><td>DC reactor terminal 2, braking unit terminal 1</td></tr>
<tr><td>(-)</td><td>/</td><td>Braking unit terminal 2</td></tr>
<tr><td>PB</td><td>Braking resistor terminal 2</td><td>This terminal is inexistent.</td></tr>
<tr><td>PE</td><td colspan="2">380V:the grounding resistor is less than 10Ohm</td><td>Protective grounding terminals, every machine is provided 2 PE terminals as the standard configuration. These terminals should be grounded with proper techniques.</td></tr>
<tr><td>A1 and A2</td><td colspan="2">Control power supply terminal</td><td>Optional parts (external 220V control power supply)</td></tr>
</table>

Note:

- ◆ Do not use an asymmetrically constructed motor cable. If there is a symmetrically constructed grounding conductor in the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the inverter and motor ends.
- ◆ Braking resistor, braking unit and DC reactor are optional parts.
- ◆ Route the motor cable, input power cable and control cables separately.
- ◆ If the terminal is not appeared, the machine does not provide the terminal as the external terminal.

4.3.3 Wiring of terminals in main circuit

1. Fasten the grounding conductor of the input power cable with the grounding terminal of the inverter (**PE**) by **360** degree grounding technique. Connect the phase conductors to **R**, **S** and **T** terminals and fasten.

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2. Strip the motor cable and connect the shield to the grounding terminal of the inverter by **360** degree grounding technique. Connect the phase conductors to **U**, **V** and **W** terminals and fasten.

3. Connect the optional brake resistor with a shielded cable to the designated position by the same procedures in the previous step.

4. Secure the cables outside the inverter mechanically.

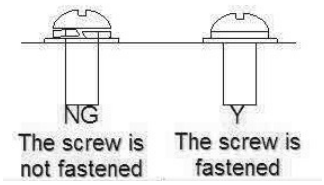

Fig 4-18 Correct installation of the screw

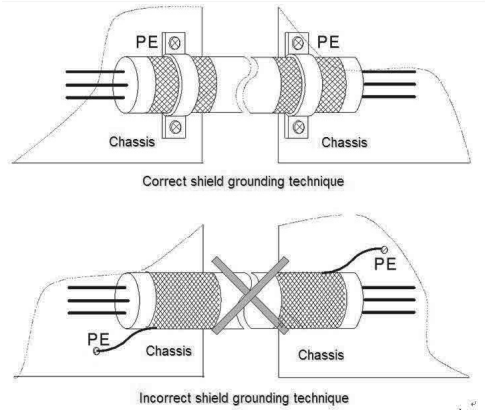

Fig 4-19 360 degree grounding technique

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4.3.4 Wiring diagram of control circuit

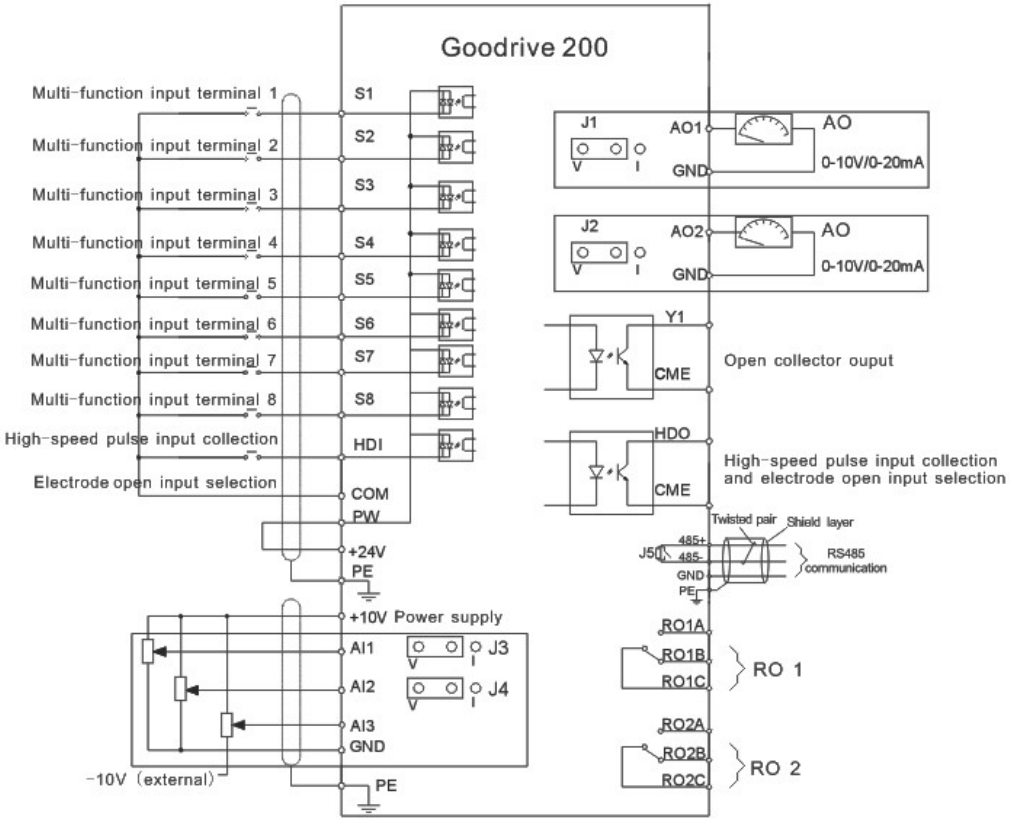

Fig 4-20 Wiring diagram of the control circuit

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4.3.5 Terminals of control circuit

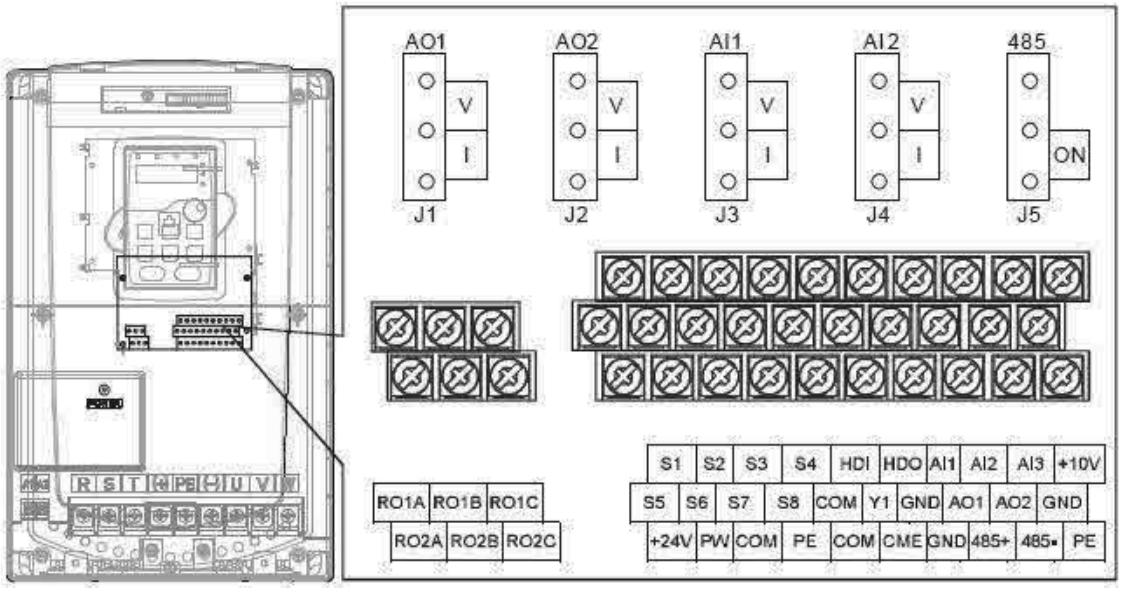
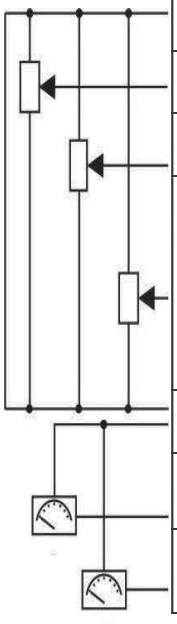


Fig 4-21 Terminals of control circuit



Terminal name	Description
+10V	Local power supply +10V
AI1	1. Input range: AI1/AI2 voltage and current can be chose: 0~10V/0~20Ma; AI1 can be shifted by J3; AI2 can be shifted by J4 AI3:-10V~+10V 2. Input impedance: voltage input: 20kΩ; current input: 500Ω 3. Resolution: the minimum one is 5mV when 10V corresponds to 50Hz 4. Deviation ±1%, 25℃
AI2	
AI3	
GND	+10V reference null potential
AO1	1. Output range:0~10V or 0~20mA; AO1 can be shifted by J1; AO2 can be shifted by J2 2. Deviation±1%,25℃
AO2	

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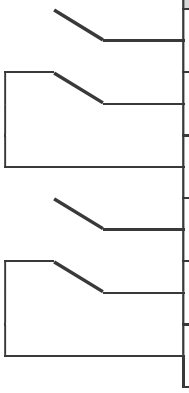
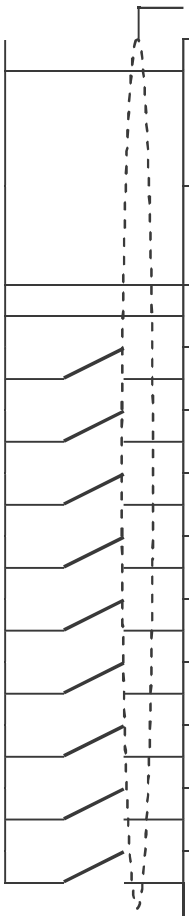


Terminal name	Description
RO1A	RO1 relay output, RO1A NO, RO1B NC, RO1C common terminal Contactor capability: 3A/AC250V,1A/DC30V
RO1B	
RO1C	
RO2A	RO2 relay output, RO2A NO, RO2B NC, RO2C common terminal Contactor capability: 3A/AC250V,1A/DC30V
RO2B	
RO2C	



Terminal name	Description	
PE	Grounding terminal	
PW	Provide the input switch working power supply from external to internal. Voltage range: 12~24V	
24V	The inverter provides the power supply for users with a maximum output current of 200mA	
COM	+24V common terminal	
S1	Switch input 1	1. Internal impedance:3.3kΩ 2. 12~30V voltage input is available 3. The terminal is the dual-direction input terminal supporting both NPN and PNP 4. Max input frequency:1kHz 5. All are programmable digital input terminal. User can set the terminal function through function codes.
S2	Switch input 2	
S3	Switch input 3	
S4	Switch input 4	
S5	Switch input 5	
S6	Switch input 6	
S7	Switch input 7	
S8	Switch input 8	
HDI	Except for S1~S8, this terminal can be used as high frequency input channel. Max. input frequency:50kHz	

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Terminal name	Description
HDO	1. Switch input:200mA/30V 2. Output frequency range:0~50kHz
COM	+24V common terminal
CME	Common terminal of HDO and Y1, short-connected with COM in factory
Y1	1.Swtich capability:200mA/30V 2.Output frequency range:0~1kHz
485+	485 communication interface and 485 differential signal interface If it is the standard 485 communication interface, please use twisted pairs or shield cable.
485-	

4.3.6 Input/Output signal connection figure

Please use U-shaped contact tag to set NPN mode or PNP mode and the internal or external power supply. The default setting is NPN internal mode.

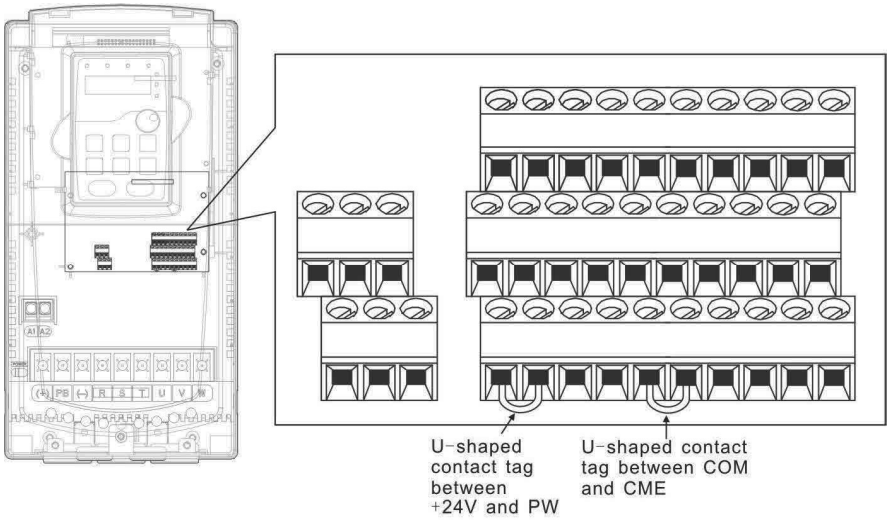

Fig 4-22 U-shaped contact tag

If the signal is from NPN transistor, please set the U-shaped contact tag between +24V and PW as below according to the used power supply.

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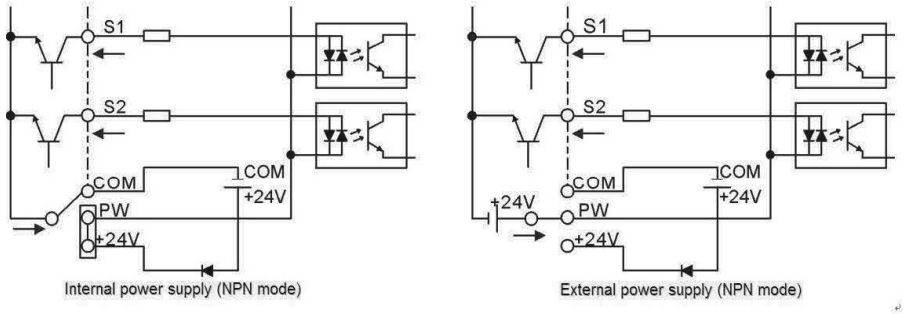

Fig 4-23 NPN modes

If the signal is from PNP transistor, please set the U-shaped contact tag as below according to the used power supply.

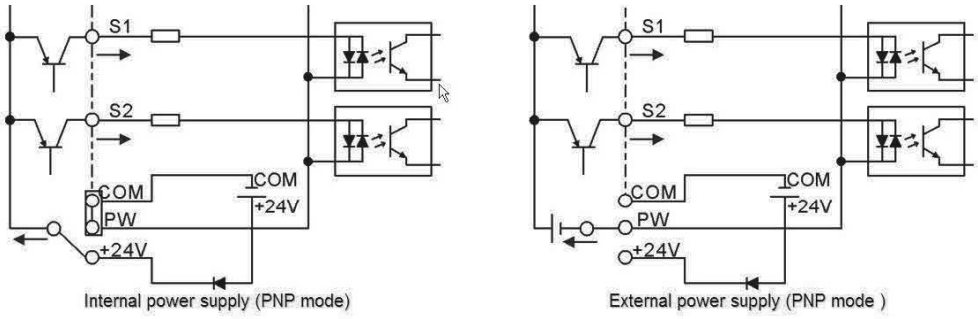

Fig 4-24 PNP modes

4.4 Layout protection

4.4.1 Protecting the inverter and input power cable in short-circuit situations

Protect the inverter and input power cable in short circuit situations and against thermal overload.

Arrange the protection according to the following guidelines.

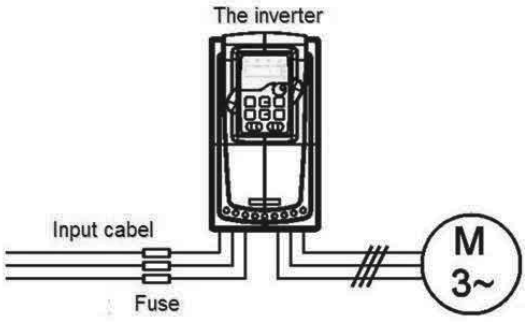

Fig 4-25 Fuse configuration

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Note: Select the fuse as the manual indicated. The fuse will protect the input power cable from damage in short-circuit situations. It will protect the surrounding devices when the internal of the inverter is short circuited.

4.4.2 Protecting the motor and motor cable in short-circuit situations

The inverter protects the motor and motor cable in a short-circuit situation when the motor cable is dimensioned according to the rated current of the inverter. No additional protection devices are needed.

	✧**If the inverter is connected to multiple motors, a separate thermal overload switch or a circuit breaker must be used for protecting each cable and motor. These devices may require a separate fuse to cut off the short-circuit current.**

4.4.3 Protecting the motor against thermal overload

According to regulations, the motor must be protected against thermal overload and the current must be switched off when overload is detected. The inverter includes a motor thermal protection function that protects the motor and closes the output to switch off the current when necessary.

4.4.4 Implementing a bypass connection

It is necessary to set power frequency and variable frequency conversion circuits for the assurance of continuous normal work of the inverter if faults occur in some significant situations.

In some special situations, for example, if it is only used in soft start, the inverter can be conversed into power frequency running after starting and some corresponding bypass should be added.

	✧**Never connect the supply power to the inverter output terminals U, V and W. Power line voltage applied to the output can result in permanent damage to the inverter.**

If frequent shifting is required, employ mechanically connected switches or contactors to ensure that the motor terminals are not connected to the AC power line and inverter output terminals simultaneously.

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Keypad Operation Procedure 5

5.1 What this chapter contains

This chapter contains following operation:

- Buttons, indicating lights and the screen as well as the methods to inspect, modify and set function codes by keypad
- Start-up

5.2 Keypad

The keypad is used to control Goodrive200 series inverters, read the state data and adjust parameters.

Fig 5-1 Keypad

Note: Standard LED keypad and optional LCD keypad are provided. The LCD keypad supports several languages, parameters copy, high-definition display and its installation dimension is compatible with the LED.

Use strew or installation bracket to fix the external keypad. The inverters of 1.5~30kW have standard bracket, while the inverters of 37~500kW have optimal bracket.

No.	Name	Description	
1	State LED	RUN/TUNE	LED off means that the inverter is in the stopping state; LED blinking means the inverter is in the parameter autotune state; LED on means the inverter is in the running state.
		FWD/REV	FED/REV LED LED off means the inverter is in the

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<table>
<tr><th>No.</th><th>Name</th><th colspan="3">Description</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td></td><td colspan="2">forward rotation state; LED on means the inverter is in the reverse rotation state</td></tr>
<tr><td>LOCAL/REMOT</td><td colspan="2">LED for keypad operation, terminals operation and remote communication control
LED off means that the inverter is in the keypad operation state; LED blinking means the inverter is in the terminals operation state; LED on means the inverter is in the remote communication control state.</td></tr>
<tr><td>TRIP</td><td colspan="2">LED for faults
LED on when the inverter is in the fault state; LED off in normal state; LED blinking means the inverter is in the pre-alarm state.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Unit LED</td><td colspan="3">Mean the unit displayed currently</td></tr>
<tr><td rowspan="5"></td><td>Hz</td><td>Frequency unit</td></tr>
<tr><td>RPM</td><td>Rotating speed unit</td></tr>
<tr><td>A</td><td>Current unit</td></tr>
<tr><td>%</td><td>Percentage</td></tr>
<tr><td>V</td><td>Voltage unit</td></tr>
<tr><td>3</td><td>Code displaying zone</td><td colspan="3">5-figure LED display displays various monitoring data and alarm code such as set frequency and output frequency.
<table>
<tr><th>Displayed word</th><th>Corresponding word</th><th>Displayed word</th><th>Corresponding word</th><th>Displayed word</th><th>Corresponding word</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>3</td><td>3</td><td>4</td><td>4</td><td>5</td><td>5</td></tr>
<tr><td>6</td><td>6</td><td>7</td><td>7</td><td>8</td><td>8</td></tr>
</table></td></tr>
</table>

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<table>
<tr><th>No.</th><th>Name</th><th colspan="3">Description</th></tr>
<tr><td></td><td></td><td colspan="3"><table>
<tr><td>9</td><td>9</td><td>A</td><td>A</td><td>b</td><td>B</td></tr>
<tr><td>C</td><td>C</td><td>d</td><td>d</td><td>E</td><td>E</td></tr>
<tr><td>F</td><td>F</td><td>H</td><td>H</td><td>I</td><td>I</td></tr>
<tr><td>L</td><td>L</td><td>n</td><td>N</td><td>n</td><td>n</td></tr>
<tr><td>o</td><td>o</td><td>P</td><td>P</td><td>r</td><td>r</td></tr>
<tr><td>S</td><td>S</td><td>t</td><td>t</td><td>U</td><td>U</td></tr>
<tr><td>v</td><td>v</td><td>.</td><td>.</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>4</td><td>Digital potentiometer</td><td colspan="3">Tuning frequency. Please refer to P08.42.</td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Buttons</td><td>PRG ESC</td><td>Programming key</td><td>Enter or escape from the first level menu and remove the parameter quickly</td></tr>
<tr><td>DATA ENT</td><td>Entry key</td><td>Enter the menu step-by-step
Confirm parameters</td></tr>
<tr><td>▲</td><td>UP key</td><td>Increase data or function code progressively</td></tr>
<tr><td>▼</td><td>DOWN key</td><td>Decrease data or function code progressively</td></tr>
<tr><td>SHIFT</td><td>Right-shift key</td><td>Move right to select the displaying parameter circularly in stopping and running mode.
Select the parameter modifying digit during the parameter modification</td></tr>
<tr><td>RUN</td><td>Run key</td><td>This key is used to operate on the inverter in key operation mode</td></tr>
<tr><td>STOP RST</td><td>Stop/
Reset key</td><td>This key is used to stop in running state and it is limited by function code P07.04
This key is used to reset all control modes in the fault alarm state</td></tr>
<tr><td>QUICK JOG</td><td>Quick key</td><td>The function of this key is confirmed by function code P07.02.</td></tr>
</table>

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5.3 Keypad displaying

The keypad displaying state of Goodrive200 series inverters is divided into stopping state parameter, running state parameter, function code parameter editing state and fault alarm state and so on.

5.3.1 Displayed state of stopping parameter

When the inverter is in the stopping state, the keypad will display stopping parameters which is shown in figure 5-2.

In the stopping state, various kinds of parameters can be displayed. Select the parameters to be displayed or not by P07.07. See the instructions of P07.07 for the detailed definition of each bit.

In the stopping state, there are 13 stopping parameters can be selected to be displayed or not. They are: setting frequency, bus voltage, input terminals state, output terminals state, PID reference, PID feedback, AI1, AI2, AI3, HDI, PLC and the current step of multi-step speeds, pulse counting value, length value. P07.07 can select the parameter to be displayed or not by bit and 》/SHIFT can shift the parameters form left to right, QUICK/JOG(P07.02=2) can shift the parameters form right to left.

5.3.2 Displayed state of running parameters

After the inverter receives valid running commands, the inverter will enter into the running state and the keypad will display the running parameters. RUN/TUNE LED on the keypad is on, while the FWD/REV is determined by the current running direction which is shown as figure 5-2.

In the running state, there are 23 parameters can be selected to be displayed or not. They are: running frequency, set frequency, bus voltage, output voltage, output torque, PID reference, PID feedback, input terminals state, output terminals state, torque set value, length value, PLC and the current step of multi-step speeds, pulse counting value, AI1, AI2, AI3, HDI, percentage of motor overload, percentage of inverter overload, ramp reference value, linear speed, AC input current. P07.05 and P07.06 can select the parameter to be displayed or not by bit and 》/SHIFT can shift the parameters form left to right, QUICK/JOG(P07.02=2) can shift the parameters from right to left.

5.3.3 Displayed state of fault

If the inverter detects the fault signal, it will enter into the fault pre-alarm displaying state. The keypad will display the fault code by flicking. The TRIP LED on the keypad is on, and the fault reset can be operated by the STOP/RST on the keypad, control terminals or

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communication commands.

5.3.4 Displayed state of function codes editing

In the state of stopping, running or fault, press PRG/ESC to enter into the editing state (if there is a password, see P07.00).The editing state is displayed on two classes of menu, and the order is: function code group/function code number→function code parameter, press DATA/ENT into the displayed state of function parameter. On this state, you can press DATA/ENT to save the parameters or press PRG/ESC to retreat.

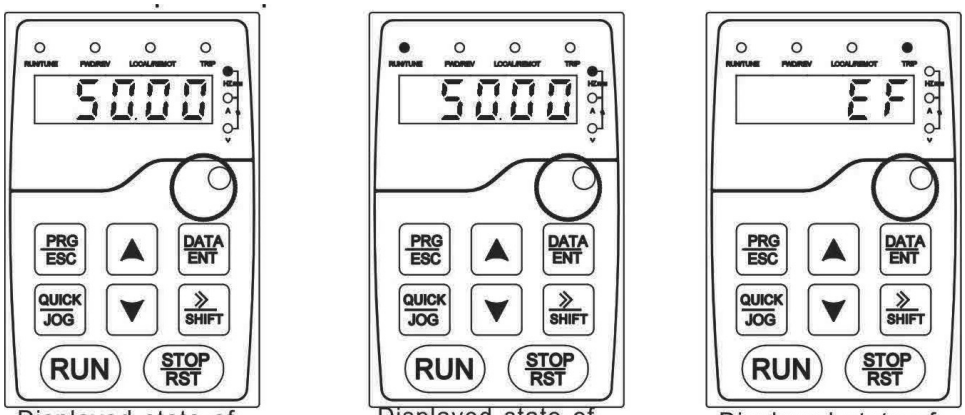

Fig 5-2 Displayed state

5.4 Keypad operation

Operate the inverter via operation panel. See the detailed structure description of function codes in the brief diagram of function codes.

5.4.1 How to modify the function codes of the inverter

The inverter has three levels menu, which are:

1. Group number of function code (first-level menu)
2. Tab of function code (second-level menu)
3. Set value of function code (third-level menu)

Remarks: Press both the PRG/ESC and the DATA/ENT can return to the second-level menu from the third-level menu. The difference is: pressing DATA/ENT will save the set parameters into the control panel, and then return to the second-level menu with shifting to the next function code automatically; while pressing PRG/ESC will directly return to the second-level menu without saving the parameters, and keep staying at the current function code.

Under the third-level menu, if the parameter has no flickering bit, it means the function code

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cannot be modified. The possible reasons could be:

1) This function code is not modifiable parameter, such as actual detected parameter, operation records and so on;

2) This function code is not modifiable in running state, but modifiable in stop state.

Example: Set function code P00.01 from 0 to 1.

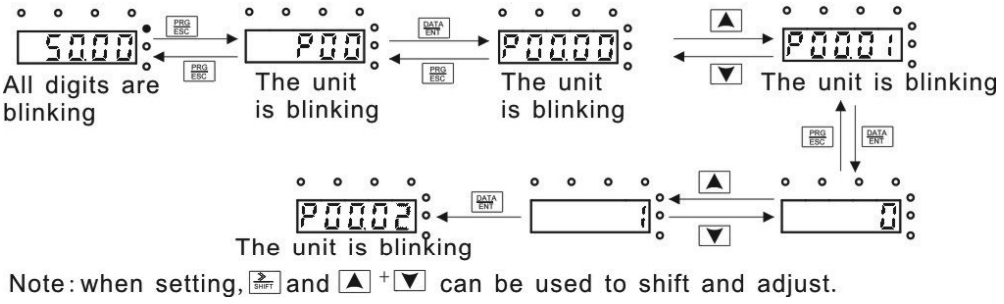

Fig 5-3 Sketch map of modifying parameters

5.4.2 How to set the password of the inverter

Goodrive200 series inverters provide password protection function to users. Set P7.00 to gain the password and the password protection becomes valid instantly after quitting from the function code editing state. Press PRG/ESC again to the function code editing state, "0.0.0.0.0" will be displayed. Unless using the correct password, the operators cannot enter it.

Set P7.00 to 0 to cancel password protection function.

The password protection becomes effective instantly after retreating form the function code editing state. Press PRG/ESC again to the function code editing state, "0.0.0.0.0" will be displayed. Unless using the correct password, the operators cannot enter it.

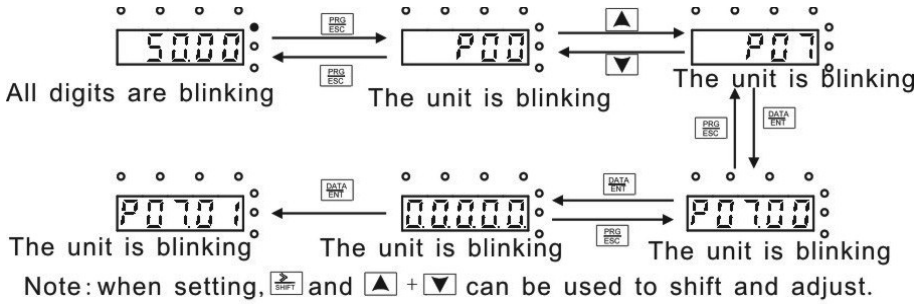

Fig 5-4 Sketch map of password setting

5.4.3 How to watch the inverter state through function codes

Goodrive200 series inverters provide group P17 as the state inspection group. Users can enter into P17 directly to watch the state.

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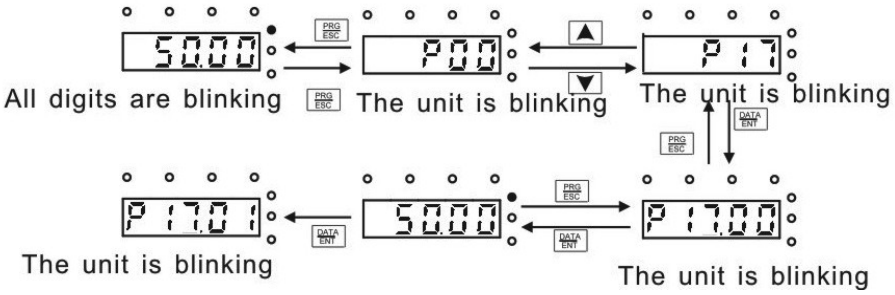

Fig 5-5 Sketch map of state watching

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Function Parameters 6

6.1 What this chapter contains

This chapter lists and describes the function parameters.

6.2 Goodrive200 general series function parameters

The function parameters of Goodrive200 series inverters have been divided into 30 groups (P00~P29) according to the function, of which P18~P28 are reserved. Each function group contains certain function codes applying 3-level menus. For example, “P08.08” means the eighth function code in the P8 group function, P29 group is factory reserved, and users are forbidden to access these parameters.

For the convenience of function codes setting, the function group number corresponds to the first level menu, the function code corresponds to the second level menu and the function code corresponds to the third level menu.

1. Below is the instruction of the function lists:

The first line “Function code”: codes of function parameter group and parameters;

The second line “Name”: full name of function parameters;

The third line “Detailed illustration of parameters”: detailed illustration of the function parameters;

The fourth line “Default value”: the original factory set value of the function parameter;

The fifth line “Modify”: the modifying character of function codes (the parameters can be modified or not and the modifying conditions), below is the instruction:

“○”: means the set value of the parameter can be modified on stop and running state;

“◎”: means the set value of the parameter can not be modified on the running state;

“●”: means the value of the parameter is the real detection value which can not be modified.

(The inverter has limited the automatic inspection of the modifying character of the parameters to help users avoid mismodifying).

2. “Parameter radix” is decimal (DEC), if the parameter is expressed by hex, then the parameter is separated from each other when editing. The setting range of certain bits are 0~F (hex).

3.”The default value” means the function parameter will restore to the default value during

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default parameters restoring. But the detected parameter or recorded value won't be restored.

4. For a better parameter protection, the inverter provides password protection to the parameters. After setting the password (set P07.00 to any non-zero number), the system will come into the state of password verification firstly after the user press PRG/ESC to come into the function code editing state. And then "0.0.0.0.0." will be displayed. Unless the user input right password, they cannot enter into the system. For the factory setting parameter zone, it needs correct factory password (remind that the users can not modify the factory parameters by themselves, otherwise, if the parameter setting is incorrect, damage to the inverter may occur). If the password protection is unlocked, the user can modify the password freely and the inverter will work as the last setting one. When P07.00 is set to 0, the password can be canceled. If P07.00 is not 0 during powering on, then the parameter is protected by the password. When modify the parameters by serial communication, the function of the password follows the above rules, too.

Function code	Name	Detailed instruction of parameters	Default value	Modify
P00 Group Basic function group				
P00.00	Speed control mode	1: Sensorless vector control mode 1 (applying to AM) No need to install encoders. It is suitable in cases with high speed control accuracy for accurate speed and torque control at all power ratings. 2:SVPWM control No need to install encoders. It can improve the control accuracy with the advantages of stable operation, valid low-frequency torque boost and current vibration suppression and the functions of slip compensation and voltage adjustment. **Note**: AM-Asynchronous motor	2	◎
P00.01	Run command channel	Select the run command channel of the inverter. The control command of the inverter includes: start-up, stop, forward, reverse, jogging and fault reset.	0	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		0:Keypad running command channel("LOCAL/REMOT" light off) Carry out the command control by RUN, STOP/RST on the keypad. Set the multi-function key QUICK/JOG as FWD/REV shifting function (P07.02=3) to change the running direction; press RUN and STOP/RST simultaneously in running state to make the inverter coast to stop. 1:Terminal running command channel ("LOCAL/REMOT" flickering) Carry out the running command control by the forward rotation, reverse rotation and forward jogging and reverse jogging of the multi-function terminals 2:Communication running command channel ("LOCAL/REMOT" on); The running command is controlled by the upper monitor via communication.		
P00.02	Communication selection	0: MODBUS communication 1~3: Reserved	0	○
P00.03	Max. output frequency	This parameter is used to set the Maximum output frequency of the inverter. Users should pay attention to this parameter because it is the foundation of the frequency setting and the speed of acceleration and deceleration. Setting range: P00.04~400.00Hz	50.00 Hz	◎
P00.04	Upper limit of the running	The upper limit of the running frequency is the upper limit of the output frequency of the inverter which is lower than or equal to the maximum	50.00 Hz	◎

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	frequency	frequency. Setting range:P00.05~P00.03 (Max. output frequency)		
P00.05	Lower limit of the running frequency	The lower limit of the running frequency is that of the output frequency of the inverter. The inverter runs at the lower limit frequency if the set frequency is lower than the lower limit one. **Note:** Max. output frequency ≥ Upper limit frequency ≥ Lower limit frequency Setting range:0.00Hz~P00.04 (Upper limit of the running frequency)	0.00Hz	◎
P00.06	A frequency command	**Note:** Frequency A and frequency B cannot use the same frequency setting mode. The frequency source can be set by P00.09.	0	○
P00.07	B frequency command	0:Keypad data setting Modify the value of P00.10 (set the frequency by keypad) to modify the frequency by the keypad. 1:Analog AI1 setting 2:Analog AI2 setting 3:Analog AI3 setting Set the frequency by analog input terminals. Goodrive200 series inverters provide 3 channels analog input terminals as the standard configuration, of which AI1/AI2 are the voltage/current option (0~10V/0~20mA) which can be shifted by jumpers; while AI3 is voltage input (-10V~+10V). **Note:** when analog AI1/AI2 select 0~20mA input, the corresponding voltage of 20mA is 10V. 100.0% of the analog input setting corresponds	2	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		to the maximum frequency (function code P00.03) in forward direction and -100.0% corresponds to the maximum frequency in reverse direction (function code P00.03) 4:High-speed pulse HDI setting The frequency is set by high-speed pulse terminals. Goodrive200 series inverters provide 1 channel high speed pulse input as the standard configuration. The pulse frequency range is 0.00~50.00kHz. 100.0% of the high speed pulse input setting corresponds to the maximum frequency in forward direction (P00.03) and -100.0% corresponds to the maximum frequency in reverse direction (P00.03). **Note:** The pulse setting can only be input by multi-function terminals HDI. Set P05.00 (HDI input selection) to high speed pulse input, and set P05.49 (HDI high speed pulse input function selection) to frequency setting input. 5:Simple PLC program setting The inverter runs at simple PLC program mode when P00.06=5 or P00.07=5. Set P10 (simple PLC and multi-step speed control) to select the running frequency, running direction, ACC/DEC time and the keeping time of corresponding step. See the function description of P10 for detailed information. 6: Multi-step speed running setting The inverter runs at multi-step speed mode when P00.06=6 or P00.07=6. Set P05 to select the		

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		current running step, and set P10 to select the current running frequency. The multi-step speed has the priority when P00.06 or P00.07 does not equal to 6, but the setting step can only be the 1~15 step. The setting step is 0~15 if P00.06 or P00.07 equals to 6. 7: PID control setting The running mode of the inverter is process PID control when P00.06=7 or P00.07=7. It is necessary to set P09. The running frequency of the inverter is the value after PID effect. See P09 for the detailed information of the preset source, preset value, and feedback source of PID. 8:MODBUS communication setting The frequency is set by MODBUS communication. See P14 for detailed information. 9~11: Reserved		
P00.08	B frequency command reference	0:Maximum output frequency, 100% of B frequency setting corresponds to the maximum output frequency 1: A frequency command, 100% of B frequency setting corresponds to the maximum output frequency. Select this setting if it needs to adjust on the base of A frequency command.	0	○
P00.09	Combination of the setting source	0: A, the current frequency setting is A freauency command 1: B, the current frequency setting is B frequency command 2: A+B, the current frequency setting is A frequency command + B frequency command	0	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		3: A-B, the current frequency setting is A frequency command - B frequency command 4: Max (A, B): the bigger one between A frequency command and B frequency is the set frequency. 5: Min (A, B): The lower one between A frequency command and B frequency is the set frequency. **Note:**The combination manner can be shifted by P05(terminal function)		
P00.10	Keypad set frequency	When A and B frequency commands are selected as “keypad setting”, this parameter will be the initial value of inverter reference frequency Setting range:0.00 Hz~P00.03 (the Max. frequency)	50.00 Hz	○
P00.11	ACC time 1	ACC time means the time needed if the inverter speeds up from 0Hz to the Max. One (P00.03). DEC time means the time needed if the inverter speeds down from the Max. Output frequency to 0Hz (P00.03). Goodrive200 series inverters define four groups of ACC/DEC time which can be selected by P05. The factory default ACC/DEC time of the inverter is the first group. Setting range of P00.11 and P00.12:0.0~3600.0s	Depend on model	○
P00.12	DEC time 1		Depend on model	○
P00.13	Running direction	0: Runs at the default direction, the inverter runs in the forward direction. FWD/REV indicator is off. 1: Runs at the opposite direction, the inverter runs in the reverse direction. FWD/REV indicator is on.	0	○

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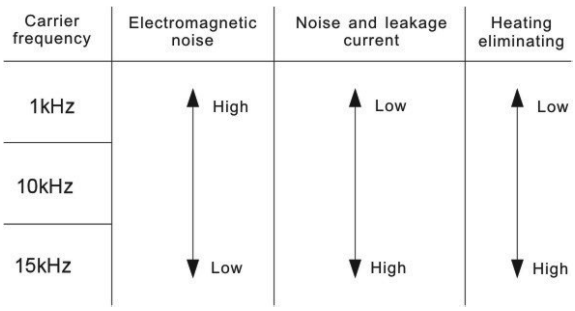
<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>Modify the function code to shift the rotation direction of the motor. This effect equals to the shifting the rotation direction by adjusting either two of the motor lines (U, V and W). In keypad control, the motor rotation direction can be changed by QUICK/JOG on the keypad. Refer to parameter P07.02.
Note: When the function parameter comes back to the default value, the motor's running direction will come back to the factory default state, too. In some cases it should be used with caution after commissioning if the change of rotation direction is disabled.
2: Forbid to run in reverse direction: It can be used in some special cases if the reverse running is disabled.</td><td></td><td></td></tr>
<tr><td>P00.14</td><td>Carrier frequency setting</td><td> 

The relationship table of the motor type and carrier frequency:
<table>
<tr><th>Model</th><th>Factory setting of carrier frequency</th></tr>
<tr><td>1.5~11kW</td><td>8kHz</td></tr>
<tr><td>15~55kW</td><td>4kHz</td></tr>
<tr><td>Above 75kW</td><td>2kHz</td></tr>
</table>
The advantage of high carrier frequency: ideal</td><td>Depend on model</td><td>○</td></tr>
</table>

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		current waveform, little current harmonic wave and motor noise. The disadvantage of high carrier frequency: increasing the switch loss, increasing inverter temperature and the impact to the output capacity. The inverter needs to derate on high carrier frequency. At the same time, the leakage and electrical magnetic interference will increase. Applying low carrier frequency is contrary to the above, too low carrier frequency will cause unstable running, torque decreasing and surge. The manufacturer has set a reasonable carrier frequency when the inverter is in factory. In general, users do not need to change the parameter. When the frequency used exceeds the default carrier frequency, the inverter needs to derate 10% for each additional 1k carrier frequency. Setting range:1.0~15.0kHz		
P00.15	Motor parameter autotuning	0:No operation 1:Rotation autotuning Comprehensive motor parameter autotune It is recommended to use rotation autotuning when high control accuracy is needed. 2:Static autotuning 1 It is suitable in the cases when the motor can not de-couple form the load. 3:Static autotuning 2 It is suitable in the cases when the motor can not de-couple form the load. But only for parts of parameters.	0	◎

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P00.16	AVR function selection	0:Invalid 1:Valid during the whole procedure The auto-adjusting function of the inverter can cancel the impact on the output voltage of the inverter because of the bus voltage fluctuation.	1	○
P00.17	Inverter type	0:G type, for the constant torque load of rated parameters 1:P type; for the variable torque load of rated parameters (fans and water pumps) GD200 series inverters can use G/P type, the available motor power of G type is small one power file than that of P type.	0	◎
P00.18	Function restore parameter	0:No operation 1:Restore the default value 2:Clear fault records **Note:** The function code will restore to 0 after finishing the operation of the selected function code. Restoring to the default value will cancel the user password, please use this function with caution.	0	◎
P01 Group Start-up and stop control				
P01.00	Start mode	0:Start-up directly:start from the starting frequency P01.01 1:Start-up after DC braking: start the motor from the starting frequency after DC braking (set the parameter P01.03 and P01.04). It is suitable in the cases where reverse rotation may occur to the low inertia load during starting. 2: Start-up after speed tracking: start the rotating motor smoothly after tracking the rotation speed and direction automatically. It is suitable in the	0	◎

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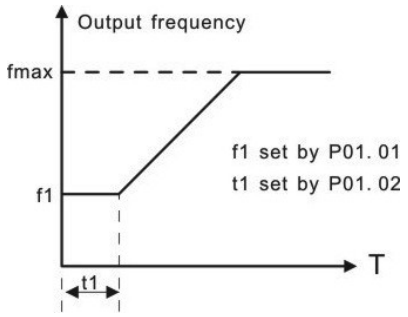
Function code	Name	Detailed instruction of parameters	Default value	Modify
		cases where reverse rotation may occur to the big inertia load during starting. Note: This function is available for the inverters of 4kW and above.		
P01.01	Starting frequency of direct start	Starting frequency of direct start-up means the original frequency during the inverter starting. See P01.02 for detailed information. Setting range: 0.00~50.00Hz	0.50Hz	◎
P01.02	Retention time of the starting frequency	Set a proper starting frequency to increase the torque of the inverter during starting. During the retention time of the starting frequency, the output frequency of the inverter is the starting frequency. And then, the inverter will run from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the inverter will stop running and keep in the stand-by state. The starting frequency is not limited in the lower limit frequency.  Setting range: 0.0~50.0s	0.0s	◎
P01.03	The braking current before	The inverter will carry out DC braking at the braking current set before starting and it will speed up after the DC braking time. If the DC braking time is set to 0, the DC braking is invalid.	0.0%	◎

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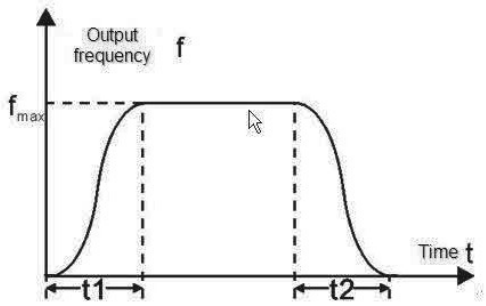
Function code	Name	Detailed instruction of parameters	Default value	Modify
	starting	The stronger the braking current, the bigger the braking power. The DC braking current before starting means the percentage of the rated current of the inverter. The setting range of P01.03: 0.0~100.0% The setting range of P01.04: 0.00~50.00s		
P01.04	The braking time before starting		0.00s	◎
P01.05	ACC/DEC selection	The changing mode of the frequency during start-up and running. 0:Linear type The output frequency increases or decreases linearly.  1:Reserved	0	◎
P01.06	Reserved			◎
P01.07	Reserved			◎
P01.08	Stop mode	0: Decelerate to stop: after the stop command becomes valid, the inverter decelerates to reduce the output frequency during the set time. When the frequency decreases to 0Hz, the inverter stops. 1: Coast to stop: after the stop command becomes valid, the inverter ceases the output immediately. And the load coasts to stop at the mechanical inertia.	0	○
P01.09	Starting	Starting frequency of DC braking: start the DC	0.00Hz	○

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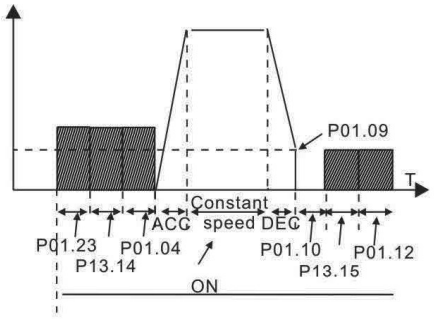
Function code	Name	Detailed instruction of parameters	Default value	Modify
	frequency of DC braking	braking when running frequency reaches starting frequency determined by P1.09. Waiting time before DC braking: Inverters block the output before starting the DC braking. After this waiting time, the DC braking will be started so as to prevent over-current fault caused by DC braking at high speed. DC braking current：The value of P01.11 is the percentage of rated current of inverter. The bigger the DC braking current is, the greater the braking torque is. DC braking time: The retention time of DC brake. If the time is 0, the DC brake is invalid. The inverter will stop at the set deceleration time.  Setting range of P01.09: 0.00Hz~P00.03 (the Max. frequency) Setting range of P01.10: 0.00~50.00s Setting range of P01.11: 0.0~100.0% Setting range of P01.12: 0.00~50.00s		
P01.10	Waiting time before DC braking		0.00s	○
P01.11	DC braking current		0.0%	○
P01.12	DC braking time		0.00s	○
P01.13	Dead time of FWD/REV rotation	During the procedure of switching FWD/REV rotation, set the threshold by P01.14, which is as the table below:	0.0s	○

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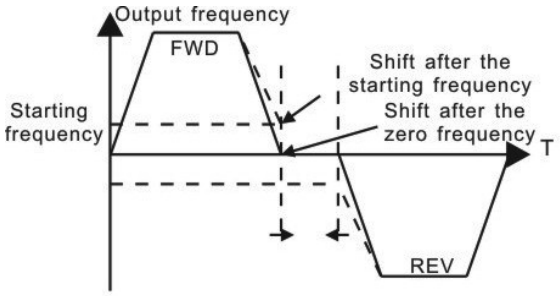
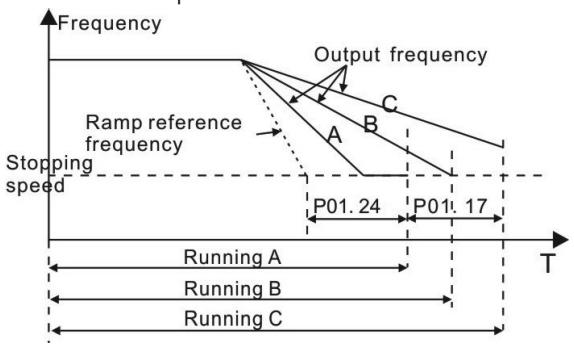
Function code	Name	Detailed instruction of parameters	Default value	Modify
		 Setting range: 0.0~3600.0s		
P01.14	Shifting between FWD/REV rotation	Set the threshold point of the inverter: 0:Switch after 0 frequency 1:Switch after the starting frequency 2:Switch after the stopping speed	0	◎
P01.15	Stopping speed	0.00~100.00Hz	0.50 Hz	◎
P01.16	Detection of stopping speed	0: Detect according to speed setting (no stopping delay) 1: Detect according to speed feedback (only valid for vector control)	1	◎
P01.17	Detection time of the feedback speed	If set P01.16 to 1, the feedback frequency is less than or equal to P01.15 and detect in the set time of P01.17, the inverter will stop; otherwise the inverter will stop after the set time of P01.17  Setting range: 0.00~100.00s (only valid when P01.16=1)	0.50s	◎
P01.18	Operation	When the running command channel is the	0	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	protection during powering on	terminal control, the system will detect the state of the running terminal during powering on. 0: The terminal running command is invalid when powering on. Even the running command is detected to be valid during powering on, the inverter won't run and the system keeps in the protection state until the running command is canceled and enabled again. 1: The terminal running command is valid when powering on. If the running command is detected to be valid during powering on, the system will start the inverter automatically after the initialization. **Note:** this function should be selected with cautions, or serious result may follow.		
P01.19	Action selection (operation frequency< lower frequency limit and valid when the lower limit >0)	This function code determines the running state of the inverter when the set frequency is lower than the lower-limit one. 0: Run at the lower limit frequency 1: Stop 2: Hibernation The inverter will coast to stop when the set frequency is lower than the lower-limit one. If the set frequency is above the lower limit one again and it lasts for the time set by P01.20, the inverter will come back to the running state automatically.	0	◎
P01.20	Hibernation restore delay time	This function code determines the hibernation delay time. When the running frequency of the inverter is lower than the lower limit one, the inverter will pause to stand by. When the set frequency is above the lower limit	0.0s	○

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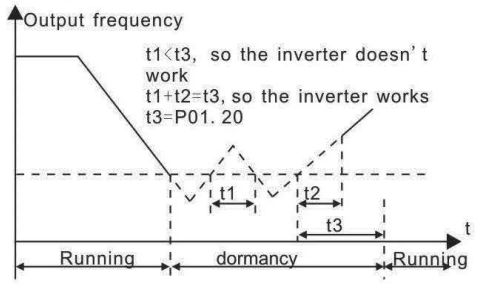
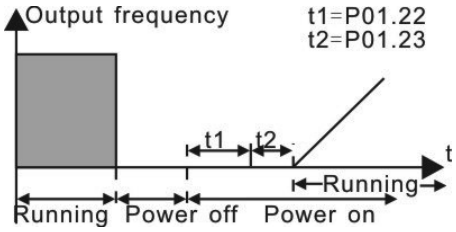
Function code	Name	Detailed instruction of parameters	Default value	Modify
		one again and it lasts for the time set by P01.20, the inverter will run automatically. **Note:** The time is the total value when the set frequency is above the lower limit one.  Setting range: 0.0~3600.0s (valid when P01.19=2)		
P01.21	Restart after power off	This function can enable the inverter start or not after the power off and then power on. 0: Disable 1: Enable, if the starting need is met, the inverter will run automatically after waiting for the time defined by P01.22.	0	○
P01.22	The waiting time of restart after power off	The function determines the waiting time before the automatic running of the inverter when powering off and then powering on.  Setting range: 0.0~3600.0s (valid when P01.21=1)	1.0s	○
P01.23	Start delay time	The function determines the brake release after the running command is reference, and the	0.0s	○

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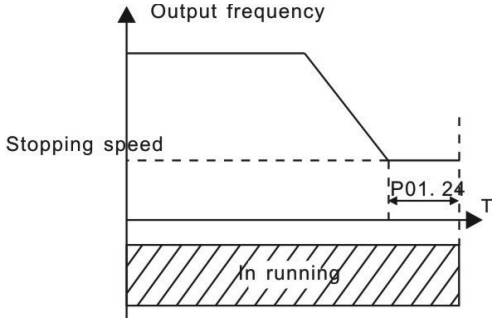
Function code	Name	Detailed instruction of parameters	Default value	Modify
		inverter is in a stand-by state and wait for the delay time set by P01.23 Setting range: 0.0~60.0s		
P01.24	Delay time of the stop speed	 Setting range: 0.0~100.0 s	0.0s	●
P01.25	0Hz output selection	0: Output without voltage 1: Output with voltage 2: Output at the DC braking current	0	●
P02 Group Motor 1				
P02.00	Reserved			◎
P02.01	Rated power of AM 1	0.1~3000.0kW	Depend on model	◎
P02.02	Rated frequency of AM 1	0.01Hz~P00.03(the Max. frequency)	50.00 Hz	◎
P02.03	Rated speed of AM 1	1~36000rpm	Depend on model	◎
P02.04	Rated voltage of AM 1	0~1200V	Depend on model	◎
P02.05	Rated current of AM 1	0.8~6000.0A	Depend on model	◎

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P02.06	Stator resistor of AM 1	0.001~65.535Ω	Depend on model	○
P02.07	Rotor resistor of AM 1	0.001~65.535Ω	Depend on model	○
P02.08	Leakage inductance of AM 1	0.1~6553.5mH	Depend on model	○
P02.09	Mutual inductance of AM 1	0.1~6553.5mH	Depend on model	○
P02.10	Non-load current of AM 1	0.1~6553.5A	Depend on model	○
P02.11	Reserved			◎
P02.12	Reserved			◎
P02.13	Reserved			◎
P02.14	Reserved			◎
P02.15	Reserved			◎
P02.16	Reserved			◎
P02.17	Reserved			◎
P02.18	Reserved			◎
P02.19	Reserved			◎
P02.20	Reserved			○
P02.21	Reserved			○
P02.22	Reserved			○
P02.23	Reserved			○
P02.24	Reserved			●
P02.25	Reserved			●

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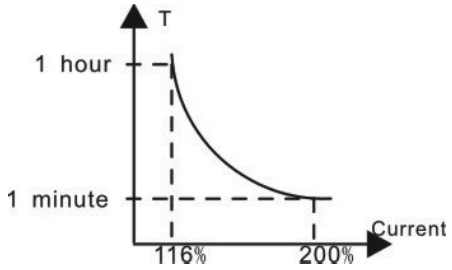
Function code	Name	Detailed instruction of parameters	Default value	Modify
P02.26	Motor 1 overload protection	0: No protection 1: Common motor (with low speed compensation). Because the heat-releasing effect of the common motors will be weakened, the corresponding electric heat protection will be adjusted properly. The low speed compensation characteristic mentioned here means reducing the threshold of the overload protection of the motor whose running frequency is below 30Hz. 2: Variable frequency motor (without low speed compensation) Because the heat-releasing effect of the specific motors won't be impacted by the rotation speed, it is not necessary to adjust the protection value during low-speed running.	2	◎
P02.27	Motor 1 over load protection coefficient	Times of motor overload M = Iout/(In*K) In is the rated current of the motor, Iout is the output current of the inverter and K is the motor protection coefficient. So, the bigger the value of K is, the smaller the value of M is. When M =116%, the fault will be reported after 1 hour, when M =200%, the fault will be reported after 1 minute, when M>=400%, the fault will be reported instantly.  Setting range: 20.0%~120.0%	100.0%	○
P02.28	Correction coefficient	Correct the power displaying of motor 1. Only impact the displaying value other than the	1.00	●

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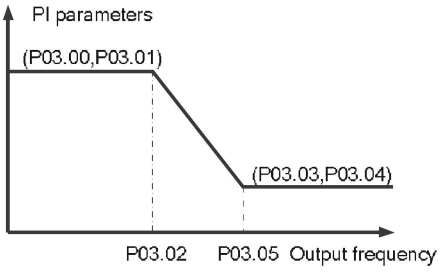
Function code	Name	Detailed instruction of parameters	Default value	Modify
	of motor 1 power	control performance of the inverter. Setting range: 0.00~3.00		
P02.29	Reserved			◆
P03 Group Vector control				
P03.00	Speed loop proportional gain1	The parameters P03.00~P03.05 only apply to vector control mode. Below the switching frequency 1(P03.02), the speed loop PI parameters are: P03.00 and P03.01. Above the switching frequency 2(P03.05), the speed loop PI parameters are: P03.03 and P03.04. PI parameters are gained according to the linear change of two groups of parameters. It is shown as below:  Setting the proportional coefficient and integral time of the adjustor can change the dynamic response performance of vector control speed loop. Increasing the proportional gain and decreasing the integral time can speed up the dynamic response of the speed loop. But too high proportional gain and too low integral time may cause system vibration and overshoot. Too low proportional gain may cause system vibration and speed static deviation. PI has a close relationship with the inertia of the	20.0	○
P03.01	Speed loop integral time1		0.200s	○
P03.02	Low switching frequency		5.00Hz	○
P03.03	Speed loop proportional gain 2		20.0	○
P03.04	Speed loop integral time 2		0.200s	○
P03.05	High switching frequency		10.00Hz	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		system. Adjust on the base of PI according to different loads to meet various demands. The setting range of P03.00:0~200.0 The setting range of P03.01: 0.000~10.000s The setting range of P03.02:0.00Hz~P03.05 The setting range of P03.03:0~200.0 The setting range of P03.04: 0.000~10.000s The setting range of P03.05:P03.02~P00.03(the Max. output frequency)		
P03.06	Speed loop output filter	0~8 (corresponds to 0~2^8/10ms)	0	○
P03.07	Compensation coefficient of electro motion slip	Slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the system. Adjusting the parameter properly can control the speed steady-state error. Setting range:50~200%	100%	○
P03.08	Compensation coefficient of braking slip		100%	○
P03.09	Current loop percentage coefficient P	**Note**: 1 These two parameters adjust the PI adjustment parameter of the current loop which affects the dynamic response speed and control accuracy directly. Generally, users do not need to change the default value. 2 Only apply to SVC control mode 0(P00.00=0). Setting range:0~65535	1000	○
P03.10	Current loop integral		1000	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	coefficient 1			
P03.11	Torque setting method	This parameter is used to enable the torque control mode, and set the torque. 0:Torque control is invalid 1:Keypad setting torque(P03.12) 2:Analog AI1 setting torque 3:Analog AI2 setting torque 4:Analog AI3 setting torque 5:Pulse frequency HDI setting torque 6:Multi-step torque setting 7:MODBUS communication setting torque 8~10:Reserved Note: Setting modes 2~10, 100% corresponds to three times of the rated current of the motor.	0	○
P03.12	Keypad setting torque	Setting range: -300.0%~300.0%(rated current of the motor)	50.0%	○
P03.13	Torque reference filter time	0.000~10.000s	0.010s	○
P03.14	Upper frequency of forward rotation in vector control	0:Keypad (P03.16 sets P03.14,P03.17 sets P03.15) 1: AI1 2: AI2 3: AI3 4:Pulse frequency HDI setting upper-limit frequency 5:Multi-step setting upper-limit frequency 6:MODBUS communication setting upper-limit	0	○
P03.15	Upper frequency		0	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	of reverse rotation in vector control	frequency 7~ 9: Reserved Note: Setting method 1~9, 100% corresponds to the maximum frequency		
P03.16	Keypad setting for upper frequency of forward rotation	This function is used to set the upper limit of the frequency. P03.16 sets the value of P03.14; P03.17 sets the value of P03.15. Setting range:0.00 Hz~P00.03 (the Max. output frequency)	50.00 Hz	○
P03.17	Keypad setting for upper frequency of reverse rotation		50.00Hz	○
P03.18	Upper electro motion torque source	This function code is used to select the electro motion and braking torque upper-limit setting source selection. 0:Keypad setting upper-limit frequency (P03.20 sets P03.18, P03.21 sets P03.19)	0	○
P03.19	Upper braking torque source	1: AI1 2: AI2 3: AI3 4: HDI 5:MODBUS communication 6~8: Reserved **Note**: setting mode 1~9,100% corresponds to three times of the motor current.	0	○

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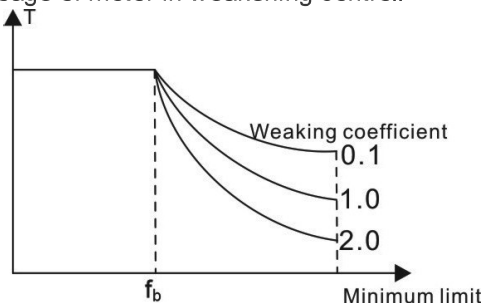
Function code	Name	Detailed instruction of parameters	Default value	Modify
P03.20	Keypad setting of electromotion torque	The function code is used to set the limit of the torque. Setting range:0.0~300.0%(motor rated current)	180.0%	○
P03.21	Keypad setting of braking torque		180.0%	○
P03.22	Weakening coefficient in constant power zone	The usage of motor in weakening control.  Function code P03.22 and P03.23 are effective at constant power. The motor will enter into the weakening state when the motor runs at rated speed. Change the weakening curve by modifying the weakening control coefficient. The bigger the weakening control coefficient is, the steeper the weak curve is. The setting range of P03.22:0.1~2.0 The setting range of P03.23:10%~100%	0.3	○
P03.23	Lowest weakening point in constant power zone		20%	○
P03.24	Max. voltage limit	P03.24 set the Max. Voltage of the inverter, which is dependent on the site situation. The setting range:0.0~120.0%	100.0%	◎
P03.25	Pre-exciting time	Reactivate the motor when the inverter starts up. Build up a magnetic field inside the inverter to improve the torque performance during the	0.300s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		starting process. The setting time:0.000~10.000s		
P03.26	Weak magnetic proportional gain	0~8000 **Note**: P03.24~P03.26 are invalid for vector mode.	1000	○
P03.27	Vector control speed	0: Display the actual value 1: Display the setting value	0	○
P03.28	Compensation coefficient of static friction	0.0~100.0% Adjust P03.28 to compensate the coefficient of static friction. Only valid when setting in 1Hz.	0.0%	○
P03.29	Compensation coefficient of dynamic friction	0.0~100.0% Adjust P03.29 to compensate the coefficient of static friction. Only valid when setting in 1Hz.	0.0%	○
P04 Group SVPWM control				
P04.00	Motor 1 V/F curve setting	These function codes define the V/F curve of Goodrive200 motor 1, and meet the need of different loads. 0:Straight line V/F curve; applying to the constant torque load 1:Multi-dots V/F curve 2:1.3th power low torque V/F curve 3:1.7th power low torque V/F curve 4:2.0th power low torque V/F curve Curves 2~4 apply to the torque loads such as fans and water pumps. Users can adjust	0	◎

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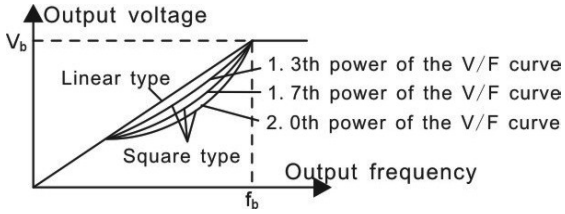
Function code	Name	Detailed instruction of parameters	Default value	Modify
		according to the features of the loads to achieve a best energy-saving effect. 5:Customized V/F(V/F separation); in this mode, V can be separated from f and f can be adjusted through the frequency reference channel set by P00.06 or the voltage reference channel set by P04.27 to change the feature of the curve. **Note:** V_b in the below picture is the motor rated voltage and f_b is the motor rated frequency. 		
P04.01	Motor 1 torque boost	Torque boost is used for the compensation of low frequency torque. P04.01 is relative to the Max. output voltage V_b. P04.02 defines the percentage of closing frequency of manual torque to f_b. Torque boost should be selected according to the load. The bigger the load is, the bigger the torque is. Too big torque boost is inappropriate because the motor will run with over magnetic, and the current of the inverter will increase to add the temperature of the inverter and decrease the efficiency. When the torque boost is set to 0.0%, the inverter is automatic torque boost. Torque boost threshold: below this frequency point, the torque boost is effective, but over this frequency point, the torque boost is invalid.	0.0%	○
P04.02	Motor 1 torque boost close		20.0%	○

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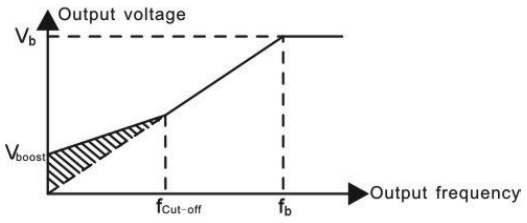
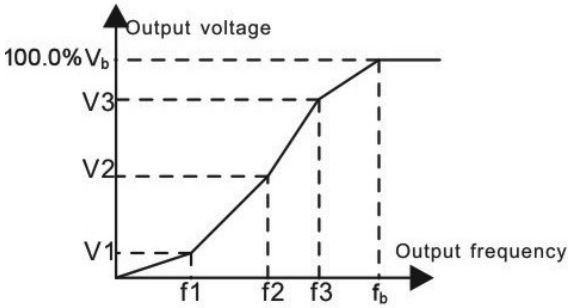
Function code	Name	Detailed instruction of parameters	Default value	Modify
		 The setting range of P04.01:0.0%:(automatic) 0.1%~10.0% The setting range of P04.02:0.0%~50.0%		
P04.03	V/F frequency 1 of motor 1	 When P04.00 =1, the user can set V//F curve through P04.03~P04.08. V/F is generally set according to the load of the motor. **Note:**V1＜V2＜V3, f1＜f2＜f3. Too high low frequency voltage will heat the motor excessively or damage. The inverter may occur the overcurrent speed or overcurrent protection. The setting range of P04.03: 0.00Hz~P04.05 The setting range of P04.04:0.0%~110.0% The setting range of P04.05:P04.03~ P04.07 The setting range of P04.06:0.0%~110.0% (the rated voltage of motor 1) The setting range of P04.07:P04.05~ P02.02 (the rated frequency of motor 1) The setting range of P04.08:0.0%~110.0%	0.00Hz	○
P04.04	V/F voltage 1 of motor 1		00.0%	○
P04.05	V/F frequency 2 of motor 1		00.00Hz	○
P04.06	V/F voltage 2 of motor 1		00.0%	○
P04.07	V/F frequency 3 of motor 1		00.00Hz	○
P04.08	V/F voltage 3 of motor 1		00.0%	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		(the rated voltage of motor 1)		
P04.09	V/F slip compensation gain of motor 1	This function code is used to compensate the change of the rotation speed caused by load during compensation SVPWM control to improve the rigidity of the motor. It can be set to the rated slip frequency of the motor which is counted as below: $\triangle f=f_b-n*p/60$ Of which, f_b is the rated frequency of the motor, its function code is P02.02; n is the rated rotating speed of the motor and its function code is P02.03; p is the pole pair of the motor. 100.0% corresponds to the rated slip frequency$\triangle$f. Setting range:0.0~200.0%	100.0%	○
P04.10	Motor 1 low frequency vibration control factor	In the SVPWM control mode, current fluctuation may occur to the motor on some frequency, especially the motor with big power. The motor can not run stably or overcurrent may occur. These phenomena can be canceled by adjusting this parameter. The setting range of P04.10:0~100 The setting range of P04.11:0~100 The setting range of P04.12:0.00Hz~P00.03 (the Max. frequency)	10	○
P04.11	Motor 1 high frequency vibration control factor		10	○
P04.12	Motor 1 vibration control threshold		30.00 Hz	○
P04.13	Reserved			◆

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P04.14	Reserved			◆
P04.15	Reserved			◆
P04.16	Reserved			◆
P04.17	Reserved			◆
P04.18	Reserved			◆
P04.19	Reserved			◆
P04.20	Reserved			◆
P04.21	Reserved			◆
P04.22	Reserved			◆
P04.23	Reserved			◆
P04.24	Reserved			◆
P04.25	Reserved			◆
P04.26	Energy-saving operation selection	0:No action 1:Automatic energy-saving operation Motor on the light load conditions, automatically adjusts the output voltage to save energy	0	◎
P04.27	Voltage setting channel	Select the output setting channel at V/F curve separation. 0: Keypad setting voltage: the output voltage is determined by P04.28. 1:AI1 setting voltage; 2:AI2 setting voltage; 3:AI3 setting voltage; 4:HDI setting voltage; 5:Multi-step speed setting voltage; 6:PID setting voltage; 7:MODBUS communication setting voltage; 8~10: Reserved **Note:** 100% corresponds to the rated voltage of the motor.	0	○
P04.28	Keypad	The function code is the voltage digital set value	100.0%	○

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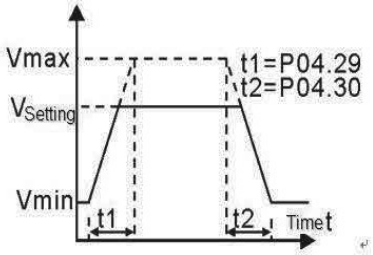
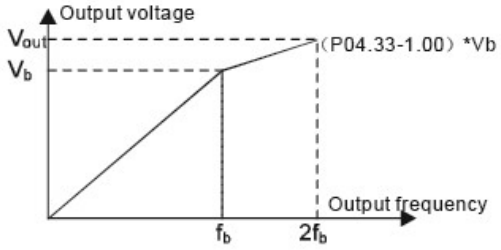
Function code	Name	Detailed instruction of parameters	Default value	Modify
	setting voltage	when the voltage setting channel is selected as "keypad selection" The setting range:0.0%~100.0%		
P04.29	Voltage increasing time	Voltage increasing time is the time when the inverter accelerates from the output minimum voltage to the output maximum voltage.	5.0s	○
P04.30	Voltage decreasing time	Voltage decreasing time is the time when the inverter decelerates from the output maximum voltage to the output minimum voltage. The setting range:0.0~3600.0s	5.0s	○
P04.31	Maximum output voltage	Set the upper and low limit of the output voltage. The setting range of P04.31:P04.32~100.0% (the rated voltage of the motor)	100.0%	◎
P04.32	Minimum output voltage	The setting range of P04.32:0.0%~ P04.31 (the rated voltage of the motor) 	0.0%	◎
P04.33	Weaking coefficient at constant power	Used to adjust the output voltage of inverter in SVPWM mode when weaking magnetic. Note: Invalid in constant-torque mode.  The setting range of P04.33: 1.00~1.30	1.00	●
P04.34	Reserved			●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P04.35	Reserved			●
P05 Group Input terminals				
P05.00	HDI input	0: HDI is high pulse input. See P05.49~P05.54 1: HDI is switch input	0	◎
P05.01	S1 terminal function selection	0: No function 1: Forward rotation 2: Reverse rotation 3: 3-wire control 4: Forward jogging 5: Reverse jogging 6: Coast to stop 7: Fault reset 8: Operation pause 9: External fault input 10:Increasing frequency setting(UP) 11:Decreasing frequency setting(DOWN) 12:Cancel the frequency change setting 13:Shift between A setting and B setting 14:Shift between combination setting and A setting 15:Shift between combination setting and B setting 16:Multi-step speed terminal 1 17:Multi-step speed terminal 2 18:Multi-step speed terminal 3 19:Multi- step speed terminal 4 20:Multi- step speed pause 21:ACC/DEC time option 1 22:ACC/DEC time option 2 23:Simple PLC stop reset 24:Simple PLC pause	1	◎
P05.02	S2 terminal function selection		4	◎
P05.03	S3 terminal function selection		7	◎
P05.04	S4 terminal function selection		0	◎
P05.05	S5 terminal function selection		0	◎
P05.06	S6 terminal function selection		0	◎
P05.07	S7 terminal function selection		0	◎
P05.08	S8 terminal function selection		0	◎
P05.09	HDI terminal function		0	◎

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>selection</td><td>25:PID control pause
26:Traverse Pause(stop at the current frequency)
27:Traverse reset(return to the center frequency)
28:Counter reset
29:Torque control prohibition
30:ACC/DEC prohibition
31:Counter trigger
32:Length reset
33:Cancel the frequency change setting temporarily
34:DC brake
35:Reserved
36:Shift the command to the keypad
37:Shift the command to the terminals
38:Shift the command to the communication
39: Pre-exciting command
40:Clear the power
41:Keep the power
42~60:Reserved
61: PID pole switching
62~63:Reserved</td><td></td><td></td></tr>
<tr><td>P05.10</td><td>Polarity selection of the input terminals</td><td>The function code is used to set the polarity of the input terminals.
Set the bit to 0, the input terminal is anode.
Set the bit to 1, the input terminal is cathode.
<table><tr><td>BIT0</td><td>BIT1</td><td>BIT2</td><td>BIT3</td><td>BIT4</td></tr><tr><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>S5</td></tr><tr><td>BIT5</td><td>BIT6</td><td>BIT7</td><td>BIT8</td><td></td></tr><tr><td>S6</td><td>S7</td><td>S8</td><td>HDI</td><td></td></tr></table>The setting range:0x000~0x1FF</td><td>0x000</td><td>○</td></tr>
<tr><td>P05.11</td><td>ON-OFF</td><td>Set the sample filter time of S1~S8 and HDI</td><td>0.010s</td><td>○</td></tr>
</table>

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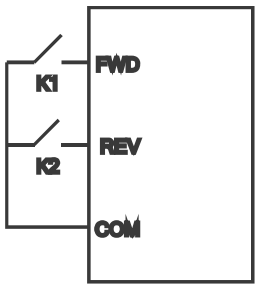
Function code	Name	Detailed instruction of parameters	Default value	Modify
	filter time	terminals. If the interference is strong, increase the parameter to avoid the disoperation. 0.000~1.000s		
P05.12	Virtual terminals setting	0x000~0x1FF(0: Disabled, 1:Enabled) BIT0:S1 virtual terminal BIT1:S2 virtual terminal BIT2:S3 virtual terminal BIT3:S4 virtual terminal BIT4:S5 virtual terminal BIT5:S6 virtual terminal BIT6:S7 virtual terminal BIT7:S8 virtual terminal BIT8:HDI virtual terminal	0x000	◎
P05.13	Terminals control running mode	Set the operation mode of the terminals control 0:2-wire control 1, comply the enable with the direction. This mode is widely used. It determines the rotation direction by the defined FWD and REV terminals command.  FWD REV Running command OFF OFF Stopping ON OFF Forward running OFF ON Reverse running ON ON Hold on 1:2-wire control 2; Separate the enable from the direction. FWD defined by this mode is the enabling ones. The direction depends on the state of the defined REV.	0	◎

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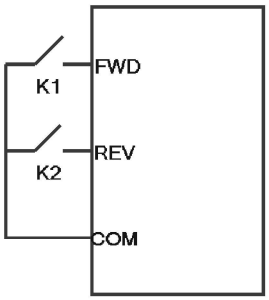
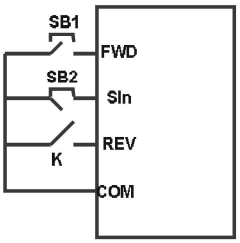
<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


<table>
<tr><th>FWD</th><th>REV</th><th>Running command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stopping</td></tr>
<tr><td>ON</td><td>OFF</td><td>Forward running</td></tr>
<tr><td>OFF</td><td>ON</td><td>Stopping</td></tr>
<tr><td>ON</td><td>ON</td><td>Reverse running</td></tr>
</table>
2:3-wire control 1; Sin is the enabling terminal on this mode, and the running command is caused by FWD and the direction is controlled by REV. Sin is natural closed.


The direction control is as below during operation:
<table>
<tr><th>Sin</th><th>REV</th><th>Previous direction</th><th>Current direction</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">OFF→ON</td><td>Forward</td><td>Reverse</td></tr>
<tr><td>Reverse</td><td>Forward</td></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">ON→OFF</td><td>Reverse</td><td>Forward</td></tr>
<tr><td>Forward</td><td>Reverse</td></tr>
<tr><td rowspan="2">ON→ OFF</td><td>ON</td><td colspan="2" rowspan="2">Decelerate to stop</td></tr>
<tr><td>OFF</td></tr>
</table>
3:3-wire control 2; Sin is the enabling terminal on this mode, and the running command is caused by SB1 or SB3 and both of them control the running direction.NC SB2 generates the stop command.
</td><td></td><td></td></tr>
</table>

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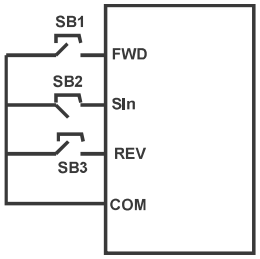
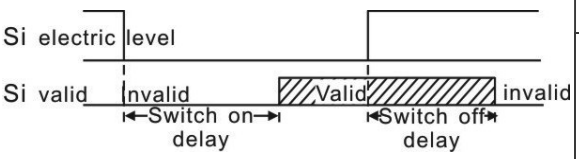
<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>


<table>
<tr><th>SIn</th><th>FWD</th><th>REV</th><th>Direction</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">OFF→ ON</td><td>ON</td><td>Forward</td></tr>
<tr><td>OFF</td><td>Reverse</td></tr>
<tr><td rowspan="2">ON</td><td>ON</td><td rowspan="2">OFF→ ON</td><td>Forward</td></tr>
<tr><td>OFF</td><td>Reverse</td></tr>
<tr><td rowspan="2">ON→ OFF</td><td></td><td></td><td rowspan="2">Decelerat e to stop</td></tr>
<tr><td></td><td></td></tr>
</table>
Note: for the 2-wire running mode, when FWD/REV terminal is valid, the inverter stop because of the stopping command from other sources, even the control terminal FWD/REV keeps valid; the inverter won't work when the stopping command is canceled. Only when FWD/REV is relaunched, the inverter can start again. For example, the valid STOP/RST stop when PLC signal cycles stop, fixed-length stop and terminal control (see P07.04).
</td><td></td><td></td></tr>
<tr><td>P05.14</td><td>S1 terminal switching-on delay time</td><td>The function code defines the corresponding delay time of electrical level of the programmable terminals from switching on to switching off.
 

Setting range:0.000~50.000s</td><td>0.000s</td><td>○</td></tr>
<tr><td>P05.15</td><td>S1 terminal switching-off delay</td><td></td><td>0.000s</td><td>○</td></tr>
</table>

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	time			
P05.16	S2 terminal switching-on delay time		0.000s	○
P05.17	S2 terminal switching-off delay time		0.000s	○
P05.18	S3 terminal switching-on delay time		0.000s	○
P05.19	S3 terminal switching-off delay time		0.000s	○
P05.20	S4 terminal switching-on delay time		0.000s	○
P05.21	S4 terminal switching-off delay time		0.000s	○
P05.22	S5 terminal switching-o		0.000s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	n delay time			
P05.23	S5 terminal switching-off delay time		0.000s	○
P05.24	S6 terminal switching-on delay time		0.000s	○
P05.25	S6 terminal switching-off delay time		0.000s	○
P05.26	S7 terminal switching-on delay time		0.000s	○
P05.27	S7 terminal switching-off delay time		0.000s	○
P05.28	S8 terminal switching-on delay		0.000s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	time			
P05.29	S8 terminal switching-off delay time		0.000s	○
P05.30	HDI terminal switching-on delay time		0.000s	○
P05.31	HDI terminal switching-off delay time		0.000s	○
P05.32	Lower limit of AI1	The function code defines the relationship between the analog input voltage and its corresponding set value. If the analog input voltage beyond the set minimum or maximum input value, the inverter will count at the minimum or maximum one. When the analog input is the current input, the corresponding voltage of 0~20mA is 0~10V. In different cases, the corresponding rated value of 100.0% is different. See the application for detailed information. The figure below illustrates different applications:	0.00V	○
P05.33	Corresponding setting of the lower limit of AI1		0.0%	○
P05.34	Upper limit of AI1		10.00V	○
P05.35	Corresponding setting of the upper limit of AI1		100.0%	○
P05.36	AI1 input		0.100s	○

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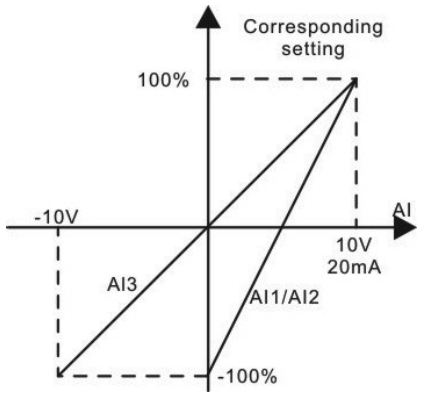
Function code	Name	Detailed instruction of parameters	Default value	Modify
	filter time			
P05.37	Lower limit of AI2	Input filter time: this parameter is used to adjust the sensitivity of the analog input. Increasing the value properly can enhance the anti-interference of the analog, but weaken the sensitivity of the analog input **Note:** Analog AI1 and AI2 can support 0~10V or 0~20mA input, when AI1 and AI2 selects 0~20mA input, the corresponding voltage of 20mA is 5V. AI3 can support the output of -10V~+10V. The setting range of P05.32:0.00V~P05.34 The setting range of P05.33:-100.0%~100.0% The setting range of P05.34:P05.32~10.00V The setting range of P05.35:-100.0%~100.0% The setting range of P05.36:0.000s~10.000s The setting range of P05.37:0.00V~P05.39 The setting range of P05.38:-100.0%~100.0% The setting range of P05.39:P05.37~10.00V The setting range of P05.40:-100.0%~100.0% The setting range of P05.41:0.000s~10.000s The setting range of P05.42:-10.00V~P05.44 The setting range of P05.43:-100.0%~100.0% The setting range of P05.44: P05.42~P05.46	0.00V	○
P05.38	Corresponding setting of the lower limit of AI2		0.0%	○
P05.39	Upper limit of AI2		10.00V	○
P05.40	Corresponding setting of the upper limit of AI2		100.0%	○
P05.41	AI2 input filter time		0.100s	○
P05.42	Lower limit of AI3		-10.00V	○
P05.43	Corresponding setting of the lower limit of AI3		-100.0%	○
P05.44	Middle value of AI3		0.00V	○
P05.45	Corresponding		0.0%	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	middle setting of AI3	The setting range of P05.45:-100.0%~100.0% The setting range of P05.46:P05.44~10.00V The setting range of P05.47:-100.0%~100.0% The setting range of P05.48:0.000s~10.000s		
P05.46	Upper limit of AI3		10.00V	○
P05.47	Corresponding setting of the upper limit of AI3		100.0%	○
P05.48	AI3 input filter time		0.100s	○
P05.49	HDI high-speed pulse input	The function selection when HDI terminals is high-speed pulse input 0:Frequency setting input, frequency setting source 1:Counter input, high-speed pulse counter input terminals 2:Length counting input, length counter input terminals	0	◎
P05.50	Lower limit frequency of HDI	0.000kHz~P05.52	0.000 kHz	○
P05.51	Corresponding setting of HDI low frequency setting	-100.0%~100.0%	0.0%	○
P05.52	Upper limit frequency	P05.50 ~50.00kHz	50.00 kHz	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	of HDI			
P05.53	Corresponding setting of upper limit frequency of HDI	-100.0%~100.0%	100.0%	○
P05.54	HDI frequency input filter time	0.000s~10.000s	0.100s	○
P06 Group Output terminals				
P06.00	HDO output	The function selection of the high-speed pulse output terminals. 0: Open collector pole high speed pulse output: The Max.pulse frequency is 50.0kHz. See P06.27~P06.31 for detailed information of the related functions. 1: Open collector pole output. See P06.02 for detailed information of the related functions.	0	◎
P06.01	Y1 output	0:Invalid 1:In operation 2:Forward rotation 3:Reverse rotation 4: Jogging 5:The inverter fault 6:Frequency degree test FDT1 7:Frequency degree test FDT2 8:Frequency arrival 9:Zero speed running 10:Upper limit frequency arrival	0	○
P06.02	HDO output		0	○
P06.03	Relay RO1 output		1	○
P06.04	Relay RO2 output		5	○

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>11:Lower limit frequency arrival
12:Ready for operation
13:Pre-magnetizing
14:Overload pre-alarm
15: Underload pre-alarm
16:Completion of simple PLC step
17:Completion of simple PLC cycle
18:Setting count value arrival
19:Defined count value arrival
20:External fault valid
21:Length arrival
22:Running time arrival
23:MODBUS communication virtual terminals output
24~25: Reserved
26: DC bus voltage establishment
27: Auxiliary motor 1
28: Auxiliary motor 2
29~30: Reserved</td><td></td><td></td></tr>
<tr><td>P06.05</td><td>Polarity selection of output terminals</td><td>The function code is used to set the pole of the output terminal.
When the current bit is set to 0, input terminal is positive.
When the current bit is set to 1, input terminal is negative.
<table><tr><td>BIT0</td><td>BIT1</td><td>BIT2</td><td>BIT3</td></tr><tr><td>Y</td><td>HDO</td><td>RO1</td><td>RO2</td></tr></table>Setting range:0~F</td><td>0</td><td>○</td></tr>
<tr><td>P06.06</td><td>Y1 switching-on delay</td><td>The function code defines the corresponding delay time of the electrical level change during the programmable terminal switching on and off.</td><td>0.000s</td><td>○</td></tr>
</table>

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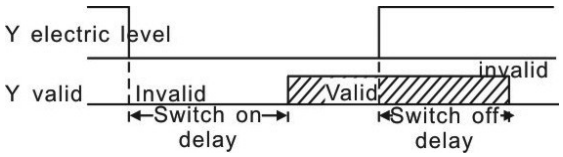
Function code	Name	Detailed instruction of parameters	Default value	Modify
	time			
P06.07	Y1 switching-off delay time	The setting range :0.000~50.000s **Note:** P06.08 and P06.09 are valid only when P06.00=1.	0.000s	○
P06.08	HDO switching-on delay time		0.000s	○
P06.09	HDO switching-off delay time		0.000s	○
P06.10	RO1 switching-on delay time		0.000s	○
P06.11	RO1 switching-off delay time		0.000s	○
P06.12	RO2 switching-on delay time		0.000s	○
P06.13	RO2 switching-off delay time		0.000s	○
P06.14	AO1 output	0:Running frequency	0	○
P06.15	AO2 output	1:Setting frequency	0	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P06.16	HDO high-speed pulse output selection	2:Ramp reference frequency 3:Running rotation speed 4:Output current (relative to twice the inverter rated current) 5:Output current (relative to twice the motor rated current) 6:Output voltage 7:Output power 8:Reserved 9:Output torque 10:Analog AI1 input value 11:Analog AI2 input value 12:Analog AI3 input value 13:High speed pulse HDI input value 14:MODBUS communication set value 1 15:MODBUS communication set value 2 16~21:Reserved 22: Torque current (relative to triple the motor rated current) 23: Ramp reference frequency(with sign) 24~30 :Reserved	0	○
P06.17	Lower limit of AO1 output	The above function codes define the relative relationship between the output value and analog output. When the output value exceeds the range of set maximum or minimum output, it will count according to the low-limit or upper-limit output. When the analog output is current output, 1mA equals to 0.5V. In different cases, the corresponding analog output of 100% of the output value is different. Please refer to each application for detailed	0.0%	○
P06.18	Corresponding AO1 output to the lower limit		0.00V	○
P06.19	Upper limit of AO1		100.0%	○

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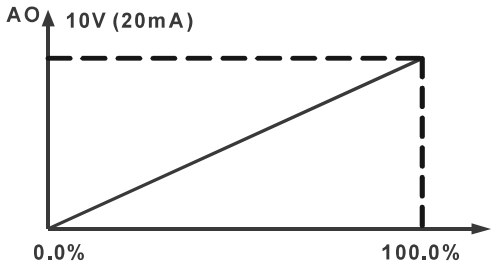
Function code	Name	Detailed instruction of parameters	Default value	Modify
	output	information.		
P06.20	The corresponding AO1 output to the upper limit		10.00V	○
P06.21	AO1 output filter time	Setting range of P06.18 0.00V~10.00V Setting range of P06.19 P06.17~100.0%	0.000s	○
P06.22	Lower limit of AO2 output	Setting range of P06.20 0.00V~10.00V Setting range of P06.21 0.000s~10.000s Setting range of P06.22 0.0%~P06.24	0.0%	○
P06.23	Corresponding AO2 output to the lower limit	Setting range of P06.23 0.00V~10.00V Setting range of P06.24 P06.22~100.0% Setting range of P06.25 0.00V~10.00V Setting range of P06.26 0.000s~10.000s Setting range of P06.27 0.000s~10.000s	0.00V	○
P06.24	Upper limit of AO2 output	Setting range of P06.28 0.00~50.00kHz Setting range of P06.29 P06.27~100.0% Setting range of P06.30 0.00~50.00kHz	100.0%	○
P06.25	Corresponding AO2 output to the upper limit	Setting range of P06.31 0.000s~10.000s	10.00V	○
P06.26	AO2 output filter time		0.000s	○
P06.27	Lower limit of HDO output		0.00%	○
P06.28	Correspon		0.00kHz	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	ding HDO output to the lower limit			
P06.29	Upper limit of HDO output		100.0%	○
P06.30	Corresponding HDO output to the upper limit		50.00 kHz	○
P06.31	HDO output filter time		0.000s	○
P07 Group Human-Machine Interface				
P07.00	User's password	0~65535 The password protection will be valid when setting any non-zero number. 00000: Clear the previous user's password, and make the password protection invalid. After the user's password becomes valid, if the password is incorrect, users cannot enter the parameter menu. Only correct password can make the user check or modify the parameters. Please remember all users' passwords. Retreat editing state of the function codes and the password protection will become valid in 1 minute. If the password is available, press PRG/ESC to enter into the editing state of the function codes, and then "0.0.0.0.0" will be	0	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		displayed. Unless input right password, the operator can not enter into it. **Note:** Restoring to the default value can clear the password, please use it with caution.		
P07.01	Parameter copy	The function code determines the mode of parameters copy. 0:No operation 1:Upload the local function parameter to the keypad 2:Download the keypad function parameter to local address(including the motor parameters) 3:Download the keypad function parameter to local address (excluding the motor parameter of P02 group) 4:Download the keypad function parameters to local address (only for the motor parameter of P02 group) **Note:** After completing the 1~4 operation, the parameter will come back to 0 automatically, the function of upload and download excludes the factory parameters of P29.	0	◎
P07.02	QUICK/JOG function selection	0:No function 1: Jogging. Press QUICK/JOG to begin the jogging running. 2: Shift the display state by the shifting key. Press QUICK/JOG to shift the displayed function code from right to left. 3: Shift between forward rotations and reverse rotations. Press QUICK/JOG to shift the direction of the frequency commands. This function is only valid in the keypad commands channels.	1	◎

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		4: Clear UP/DOWN settings. Press QUICK/JOG to clear the set value of UP/DOWN. 5: Coast to stop. Press QUICK/JOG to coast to stop. 6: Shift the running commands source. Press QUICK/JOG to shift the running commands source. 7:Quick commission mode(committee according to the non-factory parameter) **Note:** Press QUICK/JOG to shift between forward rotation and reverse rotation, the inverter does not record the state after shifting during powering off. The inverter will run according to parameter P00.13 during next powering on.		
P07.03	Shifting sequence selection of QUICK/JOG commands	When P07.02=6, set the shifting sequence of running command channels. 0:Keypad control→terminals control →communication control 1:Keypad control←→terminals control 2:Keypad control←→communication control 3:Terminals control←→communication control	0	○
P07.04	STOP/RST stop function	STOP/RST is valid for stop function. STOP/RST is valid in any state for the fault reset. 0:Only valid for the keypad control 1:Both valid for keypad and terminals control 2:Both valid for keypad and communication control 3:Valid for all control modes	0	○
P07.05	Parameters state 1	0x0000~0xFFFF BIT0:running frequency (Hz on) BIT1:set frequency(Hz flickering)	0x03FF	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		BIT2:bus voltage (Hz on) BIT3:output voltage(V on) BIT4:output current(A on) BIT5:running rotation speed (rpm on) BIT6:output power(% on) BIT7:output torque(% on) BIT8:PID reference(% flickering) BIT9:PID feedback value(% on) BIT10:input terminals state BIT11:output terminals state BIT12:torque set value(% on) BIT13:pulse counter value BIT14:length value BIT15:PLC and the current stage in multi-step speed		
P07.06	Parameters state 2	0x0000~0xFFFF BIT0: AI1 (V on) BIT1: AI2 (V on) BIT2: AI3 (V on) BIT3: HDI frequency BIT4: motor overload percentage (% on) BIT5: the inverter overload percentage (% on) BIT6: ramp frequency given value(Hz on) BIT7: linear speed BIT8: AC inlet current (A on) BIT9: upper limit frequency (Hz on) BIT10~15:reserved	0x0000	
P07.07	The parameter in the stop state	0x0000~0xFFFF BIT0:set frequency (Hz on, frequency flickering slowly) BIT1:bus voltage (V on)	0x00FF	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		BIT2:input terminals state BIT3:output terminals state BIT4:PID reference (% flickering) BIT5:PID feedback value(% flickering) BIT6:reserved BIT7:analog AI1 value(V on) BIT8:analog AI2 value(V on) BIT9: analog AI3 value(V on) BIT10:high speed pulse HDI frequency BIT11:PLC and the current step in multi-step speed BIT12:pulse counters BIT13:length value BIT14: upper limit frequency (Hz on) BIT15:reserved		
P07.08	Frequency coefficient	0.01~10.00 Displayed frequency=running frequency* P07.08	1.00	○
P07.09	Rotation speed coefficient	0.1~999.9% Mechanical rotation speed =120*displayed running frequency×P07.09/motor pole pairs	100.0%	○
P07.10	Linear speed coefficient	0.1~999.9% Linear speed= Mechanical rotation speed×P07.10	1.0%	○
P07.11	Rectifier bridge module temperature	0~100.0℃		●
P07.12	Converter module temperatur	0~100.0℃		●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	e			
P07.13	Software version	1.00~655.35		●
P07.14	Local accumulative running time	0~65535h		●
P07.15	High bit of power consumption	Display the power used by the inverter. The power consumption of the inverter =P07.15*1000+P07.16 Setting range of P07.15: 0~65535kWh (*1000) Setting range of P07.16: 0.0~999.9kWh		●
P07.16	Low bit of power consumption			●
P07.17	Inverter type	0: G type 1: P type		●
P07.18	The rated power of the inverter	0.4~3000.0kW		●
P07.19	The rated voltage of the inverter	50~1200V		●
P07.20	The rated current of the inverter	0.1~6000.0A		●
P07.21	Factory bar code 1	0x0000~0xFFFF		●
P07.22	Factory bar code 2	0x0000~0xFFFF		●
P07.23	Factory bar	0x0000~0xFFFF		●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	code 3			
P07.24	Factory bar code 4	0x0000~0xFFFF		●
P07.25	Factory bar code 5	0x0000~0xFFFF		●
P07.26	Factory bar code 6	0x0000~0xFFFF		●
P07.27	Current fault type	0:No fault 1:IGBT U phase protection(OUt1) 2:IGBT V phase protection(OUt2) 3:IGBT W phase protection(OUt3) 4:OC1 5:OC2 6:OC3 7:OV1 8:OV2 9:OV3 10:UV 11:Motor overload(OL1) 12:The inverter overload(OL2) 13:Input side phase loss(SPI) 14:Output side phase loss(SPO) 15:Overheat of the rectifier module(OH1) 16:Overheat fault of the inverter module(OH2) 17:External fault(EF) 18:485 communication fault(CE) 19:Current detection fault(ItE) 20:Motor antotune fault(tE) 21:EEPROM operation fault(EEP) 22:PID response offline fault(PIDE) 23:Braking unit fault(bCE)		●
P07.28	Previous fault type			●
P07.29	Previous 2 fault type			●
P07.30	Previous 3			●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	fault type	24:Running time arrival(END)		
P07.31	Previous 4 fault type	25:Electrical overload(OL3) 26:Panel communication fault(PCE)		●
P07.32	Previous 5 fault type	27:Parameter uploading fault (UPE) 28:Parameter downloading fault(DNE) 29~31:Reserved 32:Grounding short circuit fault 1(ETH1) 33:Grounding short circuit fault 2(ETH2) 34~35:Reserved 36: Undervoltage fault(LL)		●
P07.33	Running frequency at current fault		0.00Hz	●
P07.34	Ramp reference frequency at current fault		0.00Hz	
P07.35	Output voltage at the current fault		0V	
P07.36	Output current at current fault		0.0A	
P07.37	Bus voltage at current fault		0.0V	

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P07.38	The Max. temperature at current fault		0.0℃	
P07.39	Input terminals state at current fault		0	●
P07.40	Output terminals state at current fault		0	●
P07.41	Running frequency at previous fault		0.00Hz	●
P07.42	Ramp reference frequency at previous fault		0.00Hz	●
P07.43	Output voltage at previous fault		0V	●
P07.44	The output current at previous fault		0.0A	●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P07.45	Bus voltage at previous fault		0.0V	●
P07.46	The Max. temperature at previous fault		0.0℃	●
P07.47	Input terminals state at previous fault		0	●
P07.48	Output terminals state at previous fault		0	●
P07.49	Runnig frequency at previous 2 fault		0.00Hz	●
P07.50	Output voltage at previous 2 faults		0.00Hz	●
P07.51	Output current at previous 2 faults		0V	●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P07.52	Output current at previous 2 fault		0.0A	●
P07.53	Bus voltage at previous 2 fault		0.0V	●
P07.54	The Max. temperature at previous 2 fault		0.0℃	●
P07.55	Input terminals state at previous 2 fault		0	●
P07.56	Output terminals state at previous 2 fault		0	●
P08 Group Enhanced function				
P08.00	ACC time 2	Refer to P00.11 and P00.12 for detailed definition. Goodrive200 series define four groups of ACC/DEC time which can be selected by P5 group. The first group of ACC/DEC time is the factory default one. Setting range:0.0~3600.0s	Depend on model	○
P08.01	DEC time 2		Depend on model	○
P08.02	ACC time		Depend	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	3		on model	
P08.03	DEC time 3		Depend on model	○
P08.04	ACC time 4		Depend on model	○
P08.05	DEC time 4		Depend on model	○
P08.06	Jogging frequency	This parameter is used to define the reference frequency during jogging. Setting range: 0.00Hz ~P00.03 (the Max. frequency)	5.00Hz	○
P08.07	Jogging ACC time	The jogging ACC time means the time needed if the inverter runs from 0Hz to the Max. Frequency.	Depend on model	○
P08.08	Jogging DEC time	The jogging DEC time means the time needed if the inverter goes from the Max. Frequency (P0.03) to 0Hz. Setting range:0.0~3600.0s	Depend on model	○
P08.09	Jumping frequency 1	When the set frequency is in the range of jumping frequency, the inverter will run at the edge of the jumping frequency. The inverter can avoid the mechanical resonance point by setting the jumping frequency. The inverter can set three jumping frequency. But this function will be invalid if all jumping points are 0.	0.00Hz	○
P08.10	Jumping frequency range 1		0.00Hz	○
P08.11	Jumping frequency 2		0.00Hz	○

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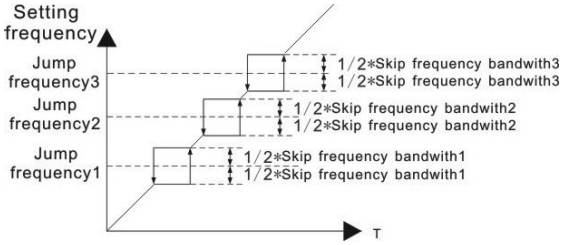
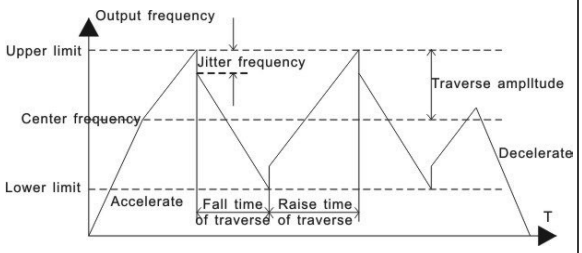
<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td>P08.12</td><td>Jumping frequency range 2</td><td rowspan="3"> 

Setting range: 0.00Hz ~P00.03 (the Max. frequency)</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.13</td><td>Jumping frequency 3</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.14</td><td>Jumping frequency range 3</td><td>0.00Hz</td><td>○</td></tr>
<tr><td>P08.15</td><td>Traverse range</td><td rowspan="4">This function applies to the industries where traverse and convolution function are required such as textile and chemical fiber.
The traverse function means that the output frequency of the inverter is fluctuated with the set frequency as its center. The route of the running frequency is illustrated as below, of which the traverse is set by P08.15 and when P08.15 is set as 0, the traverse is 0 with no function.
 

Traverse range: The traverse running is limited by upper and low frequency.
The traverse range relative to the center frequency: traverse range AW＝center frequency ×traverse range P08.15.
Sudden jumping frequency＝traverse range AW ×sudden jumping frequency range P08.16.
When run at the traverse frequency, the value</td><td>0.0%</td><td>○</td></tr>
<tr><td>P08.16</td><td>Sudden jumping frequency range</td><td>0.0%</td><td>○</td></tr>
<tr><td>P08.17</td><td>Traverse boost time</td><td>5.0s</td><td>○</td></tr>
<tr><td>P08.18</td><td>Traverse declining time</td><td>5.0s</td><td>○</td></tr>
</table>

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		which is relative to the sudden jumping frequency. The raising time of the traverse frequency: The time from the lowest point to the highest one. The declining time of the traverse frequency: The time from the highest point to the lowest one. The setting range of P08.15: 0.0~100.0% (relative to the set frequency) The setting range of P08.16: 0.0~50.0% (relative to the traverse range) The setting range of P08.17: 0.1~3600.0s The setting range of P08.18: 0.1~3600.0s		
P08.19	Setting length	The function codes of setting length, actual length and unit pulse are mainly used to control the fixed length. The length is counted by the pulse signal of HDI terminals input and the HDI terminals are needed to set as the length counting input. Actual length=the length counting input pulse /unit pulse When the actual length P08.20 exceeds the setting length P08.19, the multi-function digital output terminals will output ON. Setting range of P08.19: 0~65535m Setting range of P08.20:0~65535m Setting range of P08.21:1~10000 Setting range of P08.22:0.01~100.00cm Setting range of P08.23:0.001~10.000 Setting range of P08.24:0.001~1.000	0m	○
P08.20	Actual length		0m	●
P08.21	Pulse per rotation		1	○
P08.22	Alxe perimeter		10.00 cm	○
P08.23	Length ratio		1.000	○
P08.24	Length correcting coefficient		1.000	○
P08.25	Setting counting	The counter works by the input pulse signals of the HDI terminals.	0	○

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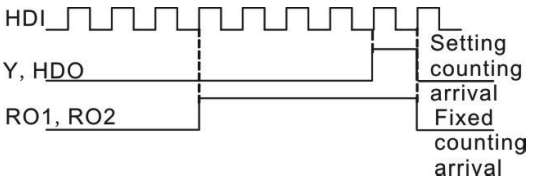
Function code	Name	Detailed instruction of parameters	Default value	Modify
	value	When the counter achieves a fixed number, the multi-function output terminals will output the signal of “fixed counting number arrival” and the counter go on working; when the counter achieves a setting number, the multi-function output terminals will output the signal of “setting counting number arrival”, the counter will clear all numbers and stop to recount before the next pulse.		
P08.26	Reference counting value	The setting counting value P08.26 should be no more than the setting counting value P08.25. The function is illustrated as below:  Setting range of P08.25:P08.26~65535 Setting range of P08.26:0~P08.25	0	○
P08.27	Set running time	Pre-set running time of the inverter. When the accumulative running time achieves the set time, the multi-function digital output terminals will output the signal of “running time arrival”. Setting range:0~65535 min	0m	○
P08.28	Fault reset times	The time of the fault reset: set the fault reset time by selecting this function. If the reset time exceeds this set value, the inverter will stop for the fault and wait to be repaired. The interval time of the fault reset: The interval between the time when the fault occurs and the time when the reset action occurs. Setting range of P08.28:0~10	0	○
P08.29	Interval time of automatic fault reset		1.0s	○

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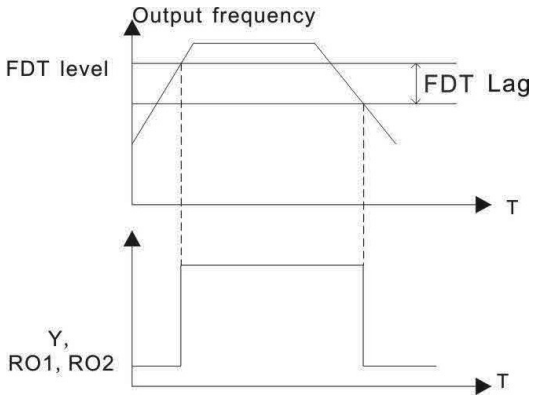
Function code	Name	Detailed instruction of parameters	Default value	Modify
		Setting range of P08.29:0.1~3600.0s		
P08.30	Frequency decreasing ratio of the dropping control	The output frequency of the inverter changes as the load. And it is mainly used to balance the power when several inverters drive one load. Setting range:0.00~10.00Hz	0.00Hz	○
P08.31	Reserved			
P08.32	FDT1 electrical level detection value	When the output frequency exceeds the corresponding frequency of FDT electrical level, the multi-function digital output terminals will output the signal of "frequency level detect FDT" until the output frequency decreases to a value lower than (FDT electrical level—FDT retention detection value) the corresponding frequency, the signal is invalid. Below is the waveform diagram:  Setting range of P08.32: 0.00Hz~P00.03 (the Max. frequency) Setting range of P08.33: -100.0~100.0% (FDT1 electrical level)	50.00 Hz	○
P08.33	FDT1 retention detection value		5.0%	○
P08.34	FDT2 electrical level detection value		50.00 Hz	○
P08.35	FDT2 retention detection value		5.0%	○

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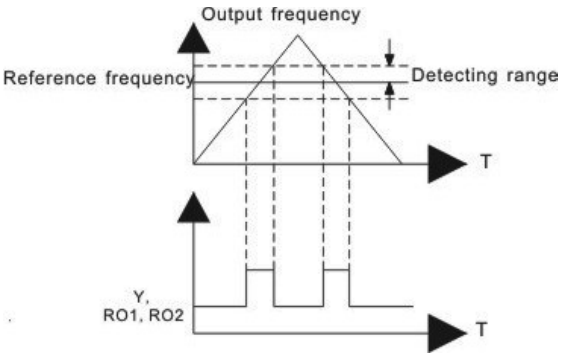
Function code	Name	Detailed instruction of parameters	Default value	Modify
		Setting range of P08.34: 0.00 Hz ~P00.03 (the Max. frequency) Setting range of P08.35: 0.0~100.0% (FDT2 electrical level)		
P08.36	Frequency arrival detection value	When the output frequency is among the below or above range of the set frequency, the multi-function digital output terminal will output the signal of "frequency arrival", see the diagram below for detailed information:  The setting range:0.00Hz~P00.03 (the Max. frequency)	0.00Hz	○
P08.37	Energy braking enable	This parameter is used to control the internal braking unit. 0:Disable 1:Enable **Note:** Only applied to internal braking unit. After enabling, the overvoltage stall point will increase by 20V more than the energy braking point.	0	○
P08.38	Threshold voltage	After setting the original bus voltage, adjust this parameter to break the load appropriately. The factory value changes with voltage level. The setting range:200.0~2000.0V In order to prevent customers set the value is too	380V voltage: 700.0V 500V voltage: 900.0V	○

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>large, it is recommended setting range:<table><tr><td>voltage</td><td>380V</td><td>500V</td><td>660</td></tr><tr><td>range</td><td>685~750V</td><td>860~950V</td><td>1080~1180V</td></tr></table></td><td>660V voltage: 1120.0V</td><td></td></tr>
<tr><td>P08.39</td><td>Cooling fan running mode</td><td>Set the operation mode of the cooling fan.
0: Normal mode, after the rectifier receives operation command or the detected temperature of module is above 45℃ or the module current is above 20% of the rated current, the fan rotates.
1:The fan keeps on running after power on (generally for the site with high temperature and humidity)</td><td>0</td><td>○</td></tr>
<tr><td>P08.40</td><td>PWM selection</td><td>0x00~0x21
LED ones: PWM mode selection
0: PWM mode 1, three-phase modulation and two-modulation
1: PWM mode 2, three-phase modulation
LED tens: low-speed carrier frequency limit mode
0: Low-speed carrier frequency limit mode 1, the carrier frequency will limit to 2k if it exceeds 2k at low speed
1:Low-speed carrier frequency limit mode 2, the carrier frequency will limit to 4k if it exceeds 4k at low speed
2: No limit</td><td>01</td><td>◎</td></tr>
<tr><td>P08.41</td><td>Over commission selection</td><td>0x00~0x11
LED ones
0: Invalid
1: Valid
LED tens
0: Light overcommission</td><td>0x01</td><td>◎</td></tr>
</table>

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		1: Heavy overcommission		
P08.42	Keypad data control	0x000~0x1223 LED ones:frequency enable selection 0:Both ∧/∨ keys and digital potentiometer adjustments are valid 1:Only ∧/∨ keys adjustment is valid 2:Only digital potentiometer adjustments is valid 3:Neither ∧/∨ keys nor digital potentiometer adjustments are valid LED tens: frequency control selection 0:Only valid when P00.06=0 or P00.07=0 1:Valid for all frequency setting manner 2:Invalid for multi-step speed when multi-step speed has the priority LED hundreds: action selection during stopping 0:Setting is valid 1:Valid during running, cleared after stopping 2:Valid during running, cleared after receiving the stop command LED thousands: ∧/∨ keys and digital potentiometer integral function 0:The integral function is valid 1:The integral function is invalid	0x0000	○
P08.43	Integral ratio of the keypad potentiometer	0.01~10.00s	0.10s	○
P08.44	UP/DOWN terminals control	0x00~0x221 LED ones: frequency control selection 0:UP/DOWN terminals setting valid	0x000	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		1:UP/DOWN terminals setting valid LED tens: frequency control selection 0:Only valid when P00.06=0 or P00.07=0 1:All frequency means are valid 2:When the multi-step are priority, it is invalid to the multi-step LED hundreds: action selection when stop 0:Setting valid 1: Valid in the running, clear after stop 2: Valid in the running, clear after receiving the stop commands		
P08.45	UP terminals frequency increasing integral ratio	0.01~50.00Hz/s	0.50 Hz/s	○
P08.46	DOWN terminals frequency integral ratio	0.01~50.00 Hz/s	0.50 Hz/s	○
P08.47	Action when the frequency setting is off	0x000~0x111 LED ones: Action selection when power off. 0:Save when power off 1:Clear when power off LED tens: Action selection when MODBUS set frequency off 0:Save when power off 1:Clear when power off LED hundreds:The action selection when other	0x000	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		frequency set frequency off 0:Save when power off 1:Clear when power off		
P08.48	High bit of initial power consumption	This parameter is used to set the original value of the power consumption. The original value of the power consumption =P08.48*1000+ P08.49 Setting range of P08.48: 0~59999°(k) Setting range of P08.49:0.0~999.9°	0°	○
P08.49	Low bit of initial power consumption		0.0°	○
P08.50	Magnetic flux braking	This function code is used to enable magnetic flux. 0: Invalid. 100~150: The bigger the coefficient, the stronger the braking is. This inverter is used to increase the magnetic flux to decelerate the motor. The energy generated by the motor during braking can be converter into heat energy by increasing the magnetic flux. The inverter monitors the state of the motor continuously even during the magnetic flux period. So the magnetic flux can be used in the motor stop, as well as to change the rotation speed of the motor. Its other advantages are: Brake immediately after the stop command. It does not need to wait the magnetic flux weaken. Better cooling for motors. The current of the stator other than the rotor increases during	0	●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		magnetic flux braking, while the cooling of the stator is more effective than the rotor.		
P08.51	Input power factor of the inverter	This function code is used to adjust the displayed current of the AC input side. Setting range:0.00~1.00	0.56	○
P09 Group	**PID control**			
P09.00	PID reference source	When the frequency command selection (P00.06, P00. 07) is 7 or the voltage setting channel selection (P04.27) is 6, the running mode of the inverter is procedure PID controlled. The parameter determines the target reference channel during the PID procures. 0:Keypad digital reference(P09.01) 1:Analog channel AI1 reference 2:Analog channel AI2 reference 3:Analog channel AI3 set 4:High speed pulse HDI set 5:Multi-step speed set 6:MODBUS communication set 7~9: Reserved The setting target of procedure PID is a relative one, 100% of the setting equals to 100% of the response of the controlled system. The system is calculated according to the relative value (0~100.0%). **Note:** Multi-step speed reference, it is realized by setting P10 group parameters.	0	○
P09.01	Keypad PID preset	When P09.00=0, set the parameter whose basic value is the feedback value of the system.	0.0%	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		The setting range:-100.0%~100.0%		
P09.02	PID feedback source	Select the PID channel by the parameter. 0:Analog channel AI1 feedback 1:Analog channel AI2 feedback 2:Analog channel AI3 feedback 3:High speed HDI feedback 4:MODBUS communication feedback 5~7:Reserved **Note:** The reference channel and the feedback channel can not coincide, otherwise, PID can not control effectively.	0	○
P09.03	PID output feature	0: PID output is positive: When the feedback signal exceeds the PID reference value, the output frequency of the inverter will decrease to balance the PID. For example, the strain PID control during wrap-up 1: PID output is negative: When the feedback signal is stronger than the PID reference value, the output frequency of the inverter will increase to balance the PID. For example, the strain PID control during wrap-down	0	○
P09.04	Proportional gain (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The parameter of 100 means that when the offset of PID feedback and reference value is 100%, the adjusting range of PID adjustor is the Max. Frequency (ignoring integral function and differential function). The setting range:0.00~100.00	1.00	○
P09.05	Integral	This parameter determines the speed of PID	0.10s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	time(Ti)	adjustor to carry out integral adjustment on the deviation of PID feedback and reference. When the deviation of PID feedback and reference is 100%, the integral adjustor works continuously after the time (ignoring the proportional effect and differential effect) to achieve the Max. Frequency (P00.03) or the Max. Voltage (P04.31). Shorter the integral time, stronger is the adjustment Setting range: 0.01~10.00s		
P09.06	Differential time(Td)	This parameter determines the strength of the change ratio when PID adjustor carries out integral adjustment on the deviation of PID feedback and reference. If the PID feedback changes 100% during the time, the adjustment of integral adjustor (ignoring the proportional effect and differential effect) is the Max. Frequency (P00.03) or the Max. Voltage (P04.31). Longer the integral time, stronger is the adjusting. Setting range: 0.00~10.00s	0. 00s	○
P09.07	Sampling cycle(T)	This parameter means the sampling cycle of the feedback. The modulator calculates in each sampling cycle. The longer the sapling cycle is, the slower the response is. Setting range: 0.000~10.000s	0.100s	○
P09.08	PID control deviation limit	The output of PID system is relative to the maximum deviation of the close loop reference. As shown in the diagram below, PID adjustor stops to work during the deviation limit. Set the function properly to adjust the accuracy and	0.0%	○

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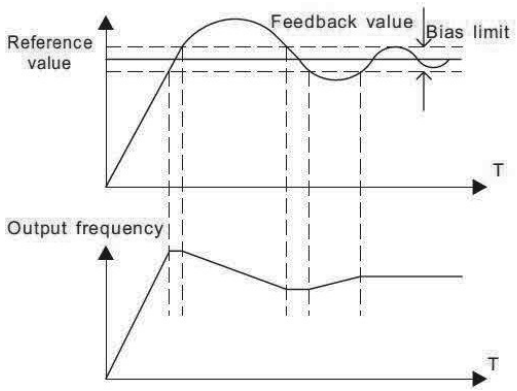
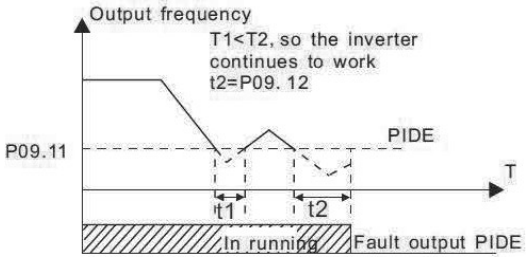
Function code	Name	Detailed instruction of parameters	Default value	Modify
		stability of the system.  Setting range:0.0~100.0%		
P09.09	Output upper limit of PID	These parameters are used to set the upper and lower limit of the PID adjustor output. 100.0 % corresponds to Max. frequency or the Max. voltage of (P04.31) Setting range of P09.09: P09.10~100.0% Setting range of P09.10: -100.0%~P09.09	100.0%	○
P09.10	Output lower limit of PID		0.0%	○
P09.11	Feedback offline detection value	Set the PID feedback offline detection value, when the detection value is smaller than or equal to the feedback offline detection value, and the lasting time exceeds the set value in P09.12, the inverter will report “PID feedback offline fault” and the keypad will display PIDE.  Setting range of P09.11: 0.0~100.0% Setting range of P09.12: 0.0~3600.0s	0.0%	○
P09.12	Feedback offline detection time		1.0s	○
P09.13	PID	0x0000~0x1111	0x0001	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	adjustment	LED ones: 0: Keep on integral adjustment when the frequency achieves the upper and low limit; the integration shows the change between the reference and the feedback unless it reaches the internal integral limit. When the trend between the reference and the feedback changes, it needs more time to offset the impact of continuous working and the integration will change with the trend. 1: Stop integral adjustment when the frequency achieves the upper and low limit. If the integration keeps stable, and the trend between the reference and the feedback changes, the integration will change with the trend quickly. LED tens: P00.08 is 0 0: The same with the setting direction; if the output of PID adjustment is different from the current running direction, the internal will output 0 forcedly. 1:Opposite to the setting direction LED hundreds: P00.08 is 0 0: Limit to the maximum frequency 1: Limit to frequency A LED thousands: 0:A+B frequency, the buffer of A frequency is invalid 1:A+B frequency, the buffer of A frequency is valid ACC/DEC is determined by ACC time 4 of P08.04		

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P09.14	Proportional gain at low frequency (Kp)	0.00~100.00	1.00	○
P09.15	PID command of ACC/DEC time	0.0~1000.0s	0.0s	○
P09.16	PID output filter time	0.000~10.000s	0.000s	○
P10 Group Simple PLC and multi-step speed control				
P10.00	Simple PLC	0: Stop after running once. The inverter has to be commanded again after finishing a cycle. 1: Run at the final value after running once. After finish a signal, the inverter will keep the running frequency and direction of the last run. 2: Cycle running. The inverter will keep on running until receiving a stop command and then, the system will stop.	0	○
P10.01	Simple PLC memory	0: Power loss without memory 1:Power loss memory; PLC record the running step and frequency when power loss.	0	○
P10.02	Multi-step speed 0	100.0% of the frequency setting corresponds to the Max. frequency P00.03. When selecting simple PLC running, set P10.02~P10.33 to define the running frequency and direction of all steps. **Note:** The symbol of multi-step determines the	0.0%	○
P10.03	The running time of step 0		0.0s	○

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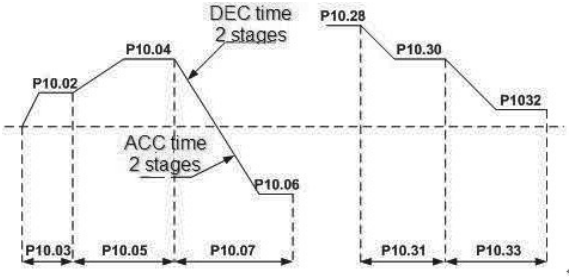
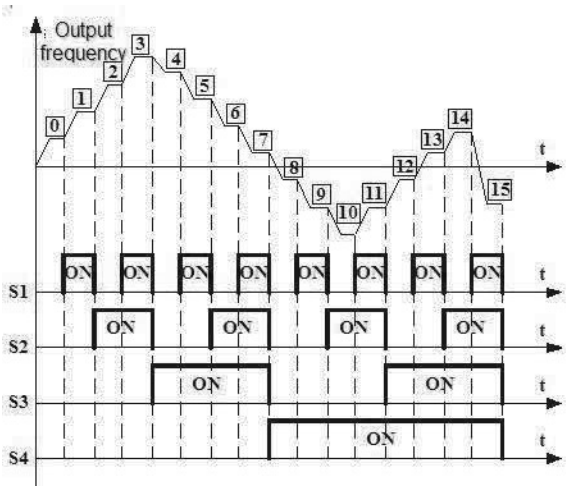
Function code	Name	Detailed instruction of parameters	Default value	Modify
P10.04	Multi-step speed 1	running direction of simple PLC. The negative value means reverse rotation.	0.0%	○
P10.05	The running time of step 1		0.0s	○
P10.06	Multi-step speed 2		0.0%	○
P10.07	The running time of step 2	Multi-step speeds are in the range of --f_{max}~f_{max} and it can be set continuously. Goodrive200 series inverters can set 16 steps speed, selected by the combination of multi-step terminals 1~4, corresponding to the speed 0 to speed 15.	0.0s	○
P10.08	Multi-step speed 3		0.0%	○
P10.09	The running time of step 3		0.0s	○
P10.10	Multi-step speed 4		0.0%	○
P10.11	The running time of step 4		0.0s	○
P10.12	Multi-step speed 5	When S1=S2=S3=S4=OFF, the frequency input manner is selected via code P00.06 or P00.07. When all S1=S2=S3=S4 terminals aren't off, it runs at multi-step which takes precedence of keypad, analog value, high-speed pulse, PLC, communication frequency input. Select at most	0.0%	○
P10.13	The running time of step 5		0.0s	○
P10.14	Multi-step		0.0%	○

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>speed 6</td><td rowspan="13">16 steps speed via the combination code of S1, S2, S3, and S4.
The start-up and stopping of multi-step running is determined by function code P00.06, the relationship between S1,S2,S3,S4 terminals and multi-step speed is as following:
<table><tr><td>S1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>S2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>S3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>S4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr><tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>S1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>S2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>S3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>S4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr></table>Setting range of P10.(2n,1<n<17):
-100.0~100.0%
Setting range of
P10.(2n+1,1<n<17):0.0~6553.5s(min)</td><td></td><td></td></tr>
<tr><td>P10.15</td><td>The running time of step 6</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.16</td><td>Multi-step speed 7</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.17</td><td>The running time of step 7</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.18</td><td>Multi-step speed 8</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.19</td><td>The running time of step 8</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.20</td><td>Multi-step speed 9</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.21</td><td>The running time of step 9</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.22</td><td>Multi-step speed 10</td><td>0.0%</td><td>○</td></tr>
<tr><td>P10.23</td><td>The running time of step 10</td><td>0.0s</td><td>○</td></tr>
<tr><td>P10.24</td><td>Multi-step speed 11</td><td>0.0%</td><td>○</td></tr>
</table>

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P10.25	The running time of step 11		0.0s	○
P10.26	Multi-step speed 12		0.0%	○
P10.27	The running time of step 12		0.0s	○
P10.28	Multi-step speed 13		0.0%	○
P10.29	The running time of step 13		0.0s	○
P10.30	Multi-step speed 14		0.0%	○
P10.31	The running time of step 14		0.0s	○
P10.32	Multi-step speed 15		0.0%	○
P10.33	The running time of step 15		0.0s	○
P10.34	Simple PLC 0~7 step	Below is the detailed instruction:	0x0000	○

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td>ACC/DEC time</td><td rowspan="2"><table>
<tr><th>Function code</th><th colspan="2">Binary bit</th><th>Step</th><th>ACC/DEC 0</th><th>ACC/DEC 1</th><th>ACC/DEC 2</th><th>ACC/DEC 3</th></tr>
<tr><td rowspan="8">P10.34</td><td>BIT1</td><td>BIT0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td rowspan="8">P10.35</td><td>BIT1</td><td>BIT0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT3</td><td>BIT2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT5</td><td>BIT4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT7</td><td>BIT6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT9</td><td>BIT8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT11</td><td>BIT10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT13</td><td>BIT12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
<tr><td>BIT15</td><td>BIT14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr>
</table>
After the users select the corresponding ACC/DEC time, the combined 16 binary bits will change into decimal bit, and then set the corresponding function codes.
Setting range: 0x0000~0xFFFF</td><td></td><td></td></tr>
<tr><td>P10.35</td><td>Simple PLC 8~15 step ACC/DEC time</td><td></td><td>0x0000</td><td>○</td></tr>
<tr><td>P10.36</td><td>PLC restart</td><td>0: Restart from the first step; stop during running (cause by the stop command, fault or power loss), run from the first step after restart.
1: Continue to run from the stop frequency; stop during running(cause by stop command and fault), the inverter will record the running time automatically, enter into the step after restart and keep the remaining running at the setting</td><td>0</td><td>◎</td></tr>
</table>

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td></td><td></td><td>frequency.</td><td></td><td></td></tr>
<tr><td>P10.37</td><td>Multi-step time unit</td><td>0: Seconds; the running time of all steps is counted by second
1: Minutes; the running time of all steps is counted by minute</td><td>0</td><td>◎</td></tr>
<tr><td colspan="5">P11 Group Protective parameters</td></tr>
<tr><td>P11.00</td><td>Phase loss protection</td><td>0x00~0x11
LED ones:
0: Input phase loss protection disable
1: Input phase loss protection enable
LED tens:
0: Input phase loss protection disable
1: Input phase loss protection enable
Note: The value for inverters of 15kW and belowis default as 10</td><td>11</td><td>○</td></tr>
<tr><td>P11.01</td><td>Sudden power loss frequency-decreasing</td><td>0: Enable
1: Disable</td><td>0</td><td>○</td></tr>
<tr><td>P11.02</td><td>Frequency decreasing ratio of sudden power loss</td><td>Setting range: 0.00Hz/s~P00.03 (the Max. frequency)
After the power loss of the grid, the bus voltage drops to the sudden frequency-decreasing point, the inverter begin to decrease the running frequency at P11.02, to make the inverter generate power again. The returning power can maintain the bus voltage to ensure a rated running of the inverter until the recovery of power.
<table>
<tr><td>Voltage degree</td><td>220V</td><td>380V</td><td>660V</td></tr>
<tr><td>Frequency-decrea</td><td>260V</td><td>460V</td><td>800V</td></tr>
</table></td><td>10.00 Hz/s</td><td>○</td></tr>
</table>

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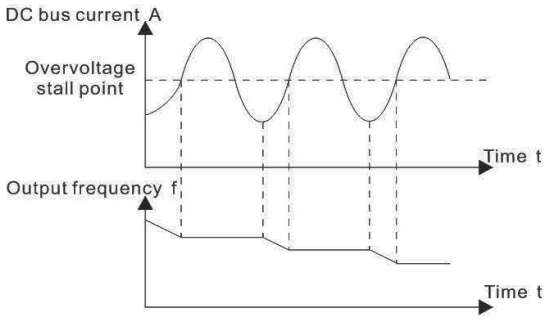
Function code	Name	Detailed instruction of parameters	Default value	Modify
		sing point at sudden power loss **Note:** 1. Adjust the parameter properly to avoid the stopping caused by inverter protection during the switching of the grid. 2. Disable input phase loss protection to enable this function.		
P11.03	Overvoltage stall protection	0:Disable 1:Enable 	1	○
P11.04	Protection voltage at overvoltage stall	120~150%(standard bus voltage) (380V)	136%	○
		120~150%(standard bus voltage) (220V)	120%	
P11.05	Current limit action selection	The actual increasing ratio is less than the ratio of output frequency because of the big load during ACC running. It is necessary to take measures to avoid overcurrent fault and the inverter trips. During the running of the inverter, this function will detect the output current and compare it with the limit defined in P11.06. If it exceeds the level, the inverter will run at stable frequency in ACC running, or the inverter will derate to run during the constant running. If it exceeds the level	01	◎
P11.06	Automatic current limit		G: 160.0% P: 120.0%	◎
P11.07	The decreasing ratio during		10.00 Hz/s	◎

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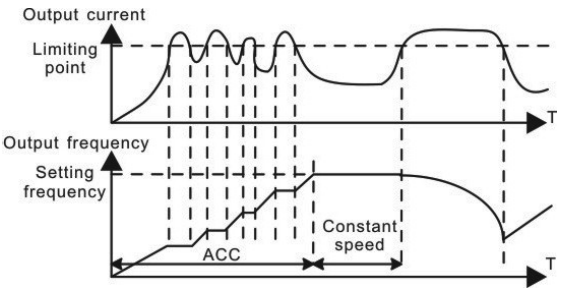
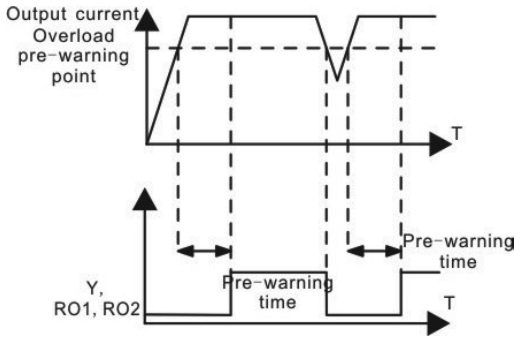
Function code	Name	Detailed instruction of parameters	Default value	Modify
	current limit	continuously, the output frequency will keep on decreasing to the lower limit. If the output current is detected to be lower than the limit level, the inverter will accelerate to run.  Setting range of P11.05: 0x00~0x11 LED ones:current limit 0:Invalid 1:Always invalid LED tens:overload alarm 0:Valid 1: Invalid Setting range of P11.06: 50.0~200.0% Setting range of P11.07: 0.00~50.00Hz/s		
P11.08	Overload pre-alarm of the motor/inverter	The output current of the inverter or the motor is above P11.09 and the lasting time is beyond P11.10, overload pre-alarm will be output.  	0x000	○
P11.09	Overload pre-alarm test level		G: 150% P: 120%	○
P11.10	Overload pre-alarm		1.0s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	detection time	Setting range of P11.08: Enable and define the overload pre-alarm of the inverter or the motor. Setting range: 0x000~0x131 LED ones: 0:Overload pre-alarm of the motor, comply with the rated current of the motor 1:Overload pre-alarm of the inverter, comply with the rated current of the inverter LED tens: 0:The inverter continues to work after underload pre-alarm 1:The inverter continues to work after underload pre-alarm and the inverter stops running after overload fault 2: The inverter continues to work after overload pre-alarm and the inverter stops running after underload fault 3. The inverter stops when overloading or underloading. LED hundreds : 0:Detection all the time 1:Detection in constant running Setting range of P11.09: P11.11~200% Setting range of P11.10: 0.1~3600.0s		
P11.11	Detection level of the underload pre-alarm	If the inverter current or the output current is lower than P11.11, and its lasting time is beyond P11.12, the inverter will output underload pre-alarm.	50%	○
P11.12	Detection time of the	Setting range of P11.11: 0~P11.09 Setting range of P11.12: 0.1~3600.0s	1.0s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	underload pre-alarm			
P11.13	Output terminal action during fault	Select the action of fault output terminals on undervoltage and fault reset. 0x00~0x11 LED ones: 0:Action under fault undervoltage 1:No action under fault undervoltage LED tens: 0:Action during the automatic reset 1:No action during the automatic reset	0x00	○
P11.14	Reserved			●
P11.15	Reserved			○
P11.16	Automatic frequency-decreasing at voltage drop	0:Invalid 1:Valid; ensure rated output torque when voltage drop	0	
P12 Group Reserved				
P13 Group Reserved				
P13.00~ P13.12	Reserved			

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P13.13	Braking current of short-circuit	When P01.00=0 during the starting of the inverter, set P13.14 to a non-zero value to enter the short circuit braking.	0.0%	○
P13.14	Braking retention time before starting	When the running frequency is lower than P01.09 during the stopping of the inverter, set 13.15 to a non-zero value to enter into stopping short circuited braking and then carry out the DC braking at the time set by P01.12 (refer to the instruction of P01.09~P01.12) .	0.00s	○
P13.15	The braking retention time when stopping	Setting range of P13.13: 0.0~150.0% (the inverter) Setting range of P13.14: 0.00~50.00s Setting range of P13.15: 0.00~50.00s	0.00s	○
P14 Group Serial communication				
P14.00	Local communication address	The setting range:1~247 When the master is writing the frame, the communication address of the slave is set to 0; the broadcast address is the communication address. All slaves on the MODBUS fieldbus can receive the frame, but the salve doesn't answer. The communication address of the drive is unique in the communication net. This is the fundamental for the point to point communication between the upper monitor and the drive. **Note:** The address of the slave cannot set to 0.	1	○
P14.01	Communic	Set the digital transmission speed between the	4	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	ation baud ratio	upper monitor and the inverter. 0:1200BPS 1:2400BPS 2:4800BPS 3:9600BPS 4:19200BPS 5:38400BPS 6:57600BPS 7:115200BPS **Note:** The baud rate between the upper monitor and the inverter must be the same. Otherwise, the communication is not applied. The bigger the baud rate, the quicker the communication speed.		
P14.02	Digital bit checkout	The data format between the upper monitor and the inverter must be the same. Otherwise, the communication is not applied. 1: Even check (E,8,1) for RTU 2: Odd check (O,8,1) for RTU 3:No check (N,8,2) for RTU 4: Even check (E,8,2) for RTU 5: Odd check(O,8,2) for RTU	1	○
P14.03	Answer delay	0~200ms It means the interval time between the interval time when the drive receive the data and sent it to the upper monitor. If the answer delay is shorter than the system processing time, then the answer delay time is the system processing time, if the answer delay is longer than the system processing time, then after the system deal with the data, waits until achieving the answer delay time to send the data to the upper monitor.	5	○
P14.04	Fault time	0.0(invalid), 0.1~60.0s	0.0s	○

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	of communication overtime	When the function code is set as 0.0, the communication overtime parameter is invalid. When the function code is set as non-zero, if the interval time between two communications exceeds the communication overtime, the system will report “485 communication faults” (CE). Generally, set it as invalid; set the parameter in the continuous communication to monitor the communication state.		
P14.05	Transmission fault processing	0:Alarm and stop freely 1:No alarm and continue to run 2:No alarm and stop according to the stop means (only under the communication control) 3:No alarm and stop according to the stop means (under all control modes)	0	○
P14.06	Communication processing	LED ones: 0: Operation with response: the drive will respond to all reading and writing commands of the upper monitor. 1:Operation without response; The drive only responds to the reading command other than the writing command of the drive. The communication efficiency can be increased by this method. LED tens: 0: Communication encrypting valid 1: Communication encrypting invalid	0x00	○
P14.07	Reserved			●
P14.08	Reserved			●
P15 Group Reserved				

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<table>
<tr><th>Function code</th><th>Name</th><th>Detailed instruction of parameters</th><th>Default value</th><th>Modify</th></tr>
<tr><td colspan="5">P16 Group Ethernet function</td></tr>
<tr><td colspan="5">P17 Group Monitoring function</td></tr>
<tr><td>P17.00</td><td>Setting frequency</td><td>Display current set frequency of the inverter
Range: 0.00Hz~P00.03</td><td></td><td>●</td></tr>
<tr><td>P17.01</td><td>Output frequency</td><td>Display current output frequency of the inverter
Range: 0.00Hz~P00.03</td><td></td><td>●</td></tr>
<tr><td>P17.02</td><td>Ramp reference frequency</td><td>Display current ramp reference frequency of the inverter
Range: 0.00Hz~P00.03</td><td></td><td>●</td></tr>
<tr><td>P17.03</td><td>Output voltage</td><td>Display current output voltage of the inverter
Range: 0~1200V</td><td></td><td>●</td></tr>
<tr><td>P17.04</td><td>Output current</td><td>Display current output current of the inverter
Range: 0.0~3000.0A</td><td></td><td>●</td></tr>
<tr><td>P17.05</td><td>Motor speed</td><td>Display the rotation speed of the motor.
Range: 0~65535RPM</td><td></td><td>●</td></tr>
<tr><td>P17.06</td><td>Reserved</td><td></td><td></td><td>●</td></tr>
<tr><td>P17.07</td><td>Reserved</td><td></td><td></td><td>●</td></tr>
<tr><td>P17.08</td><td>Motor power</td><td>Display current motor power
Range:-300~300%</td><td></td><td>●</td></tr>
<tr><td>P17.09</td><td>Output torque</td><td>Display the current output torque of the inverter.
Range: -250.0~250.0%</td><td></td><td>●</td></tr>
<tr><td>P17.10</td><td>Evaluated motor frequency</td><td>Evaluated frequency of motor rotor
Range: 0.00Hz~ P00.03</td><td></td><td>●</td></tr>
<tr><td>P17.11</td><td>DC bus voltage</td><td>Display current DC bus voltage of the inverter
Range: 0.0~2000.0V</td><td></td><td>●</td></tr>
<tr><td>P17.12</td><td>ON-OFF input terminals state</td><td>Display current Switch input terminals state of the inverter
<table>
<tr><td></td><td>BIT8</td><td>BIT7</td><td>BIT6</td><td>BIT5</td></tr>
<tr><td></td><td>HDI</td><td>S8</td><td>S7</td><td>S6</td></tr>
<tr><td>BIT4</td><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr>
</table></td><td></td><td>●</td></tr>
</table>

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Function code	Name	Detailed instruction of parameters	Default value	Modify
		S5 S4 S3 S2 S1 Range: 0000~00FF		
P17.13	ON-OFF output terminals state	Display current Switch output terminals state of the inverter BIT3 BIT2 BIT1 BIT0 RO2 RO1 HDO Y Range: 0000~000F		●
P17.14	Digital adjustment	Display the adjustment through the keypad of the inverter. Range : 0.00Hz~P00.03		●
P17.15	torque reference	Display the torque given, the percentage to the current rated torque of the motor. Setting range: -300.0%~300.0% (the rated current of the motor)		●
P17.16	Linear speed	Display the current linear speed of the inverter. Range: 0~65535		●
P17.17	Length	Display the current length of the inverter. Range: 0~65535		●
P17.18	Counting value	Display the current counting number of the inverter. Range: 0~65535		●
P17.19	AI1 input voltage	Display analog AI1 input signal Range: 0.00~10.00V		●
P17.20	AI2 input voltage	Display analog AI2 input signal Range: 0.00~10.00V		●
P17.21	AI3 input voltage	Display analog AI2 input signal Range: -10.00~10.00V		●
P17.22	HDI input frequency	Display HDI input frequency Range: 0.000~50.000kHz		●
P17.23	PID reference	Display PID reference value Range: -100.0~100.0%		●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	value			
P17.24	PID feedback value	Display PID response value Range: -100.0~100.0%		●
P17.25	Power factor of the motor	Display the current power factor of the motor. Range: -1.00~1.00		●
P17.26	Current running time	Display the current running time of the inverter. Range:0~65535min		●
P17.27	Simple PLC and the current step of the multi-step speed	Display simple PLC and the current step of the multi-step speed Range: 0~15		●
P17.28	Reserved			●
P17.29	Reserved			●
P17.30	Reserved			●
P17.31	Reserved			●
P17.32	Reserved			●
P17.33	Reserved			●
P17.34	Reserved			●
P17.35	AC input current	Display the input current in AC side. Range: 0.0~5000.0A		●
P17.36	Output torque	Display the output torque. Positive value is in the electromotion state, and negative is in the power generating state. Range : -3000.0Nm~3000.0Nm		●
P17.37	Counting	0~100 (100 is OL1 fault)		●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
	of the motor overload			
P17.38	PID output	-100.00~100.00%	0.00%	●
P17.39	Wrong download of parameters	0.00~99.99	0.00	●
P24 Group Water supply				
P24.00	Water supply selection	0: Disabled 1: Enabled	0	◎
P24.01	Press feedback source	0: AI1 setting value 1: AI2 setting value 2: AI3 setting value 3: HDI setting value	0	○
P24.02	Hibernation check	0: Hibernate as the setting frequency < P24.03 1: Hibernate as the feedback pressure > P24.04	0	◎
P24.03	Starting frequency of the hibernation	0.00~P0.03(the Max. frequency)	10.00 Hz	○
P24.04	Starting pressure of hibernation	0.00~100.0%	50.0%	○
P24.05	Hibernation delay time	0.0~3600.0s	5.0s	○
P24.06	Hibernation awake	0: Awake as the setting frequency > P24.07 1: Awake as the feedback pressure < P24.08	0	◎

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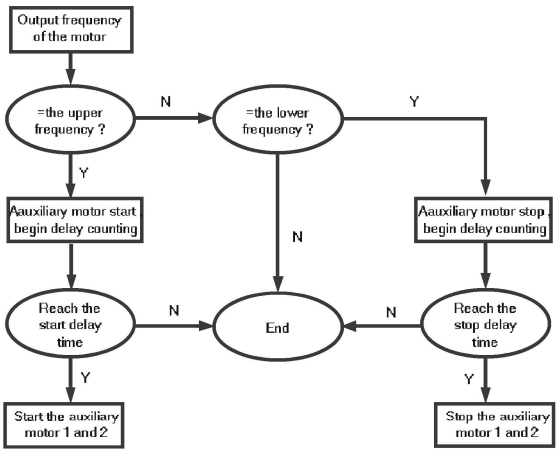
Function code	Name	Detailed instruction of parameters	Default value	Modify
P24.07	Awake frequency	0.00~P0.03(the Max. frequency)	20.00 Hz	○
P24.08	Setting value of hibernation awake	0.00~100.0%	10.0%	○
P24.09	Mini hibernation time	0.0~3600.0s	5.0s	○
P24.10	Valid auxiliary motor	P24.10~P24.12 can make three motors to form a simple system of water supply.  P24.10 is used to select the valid auxiliary motor. 0: No auxiliary motor 1: Auxiliary motor 1 valid 2: Auxiliary motor 2 valid 3: Auxiliary motor 1 and 2 valid Setting range of P24.10: 0.0~3600.0s Setting range of P24.11: 0.0~3600.0s	0	○
P24.11	Start/stop delay time of auxiliary motor 1		5.0s	○
P24.12	Start/stop delay time of auxiliary motor 2		5.0s	○
P24.13	Reserved	0~1	0	●
P24.14	Reserved	0~1	0	●
P24.15	Reserved	0~1	0	●

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Function code	Name	Detailed instruction of parameters	Default value	Modify
P24.16	Reserved	0~1	0	●
P24.17	Reserved	0~1	0	●
P24.18	Reserved	0~1	0	●
P24.19	Reserved	0~1	0	●

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Basic Operation Instruction 7

7.1 What this chapter contains

This chapter describes the internal function mode of the inverter in details.

	✧**Check all terminals are connected properly and tightly.** ✧**Check that the power of the motor corresponds to that of the inverter.**

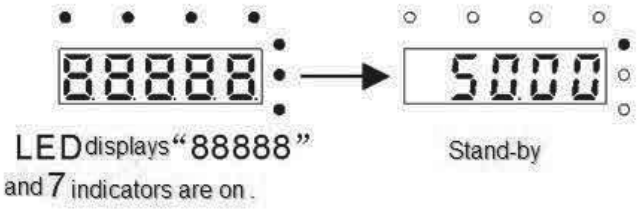
7.2 First powering on

Check before powering on

Please check according to the installation list in chapter two.

Original powering operation

Check to ensure there is no mistake in wiring and power supply, switch on the air switch of the AC power supply on the input side of the inverter to power on the inverter. 8.8.8.8.8. will be displayed on the keypad, and the contactor closes normally. When the character on the nixie tubs changes to the set frequency, the inverter has finished the initialization and it is in the stand-by state.



Below diagram shows the first operation: (take motor 1 as the example)

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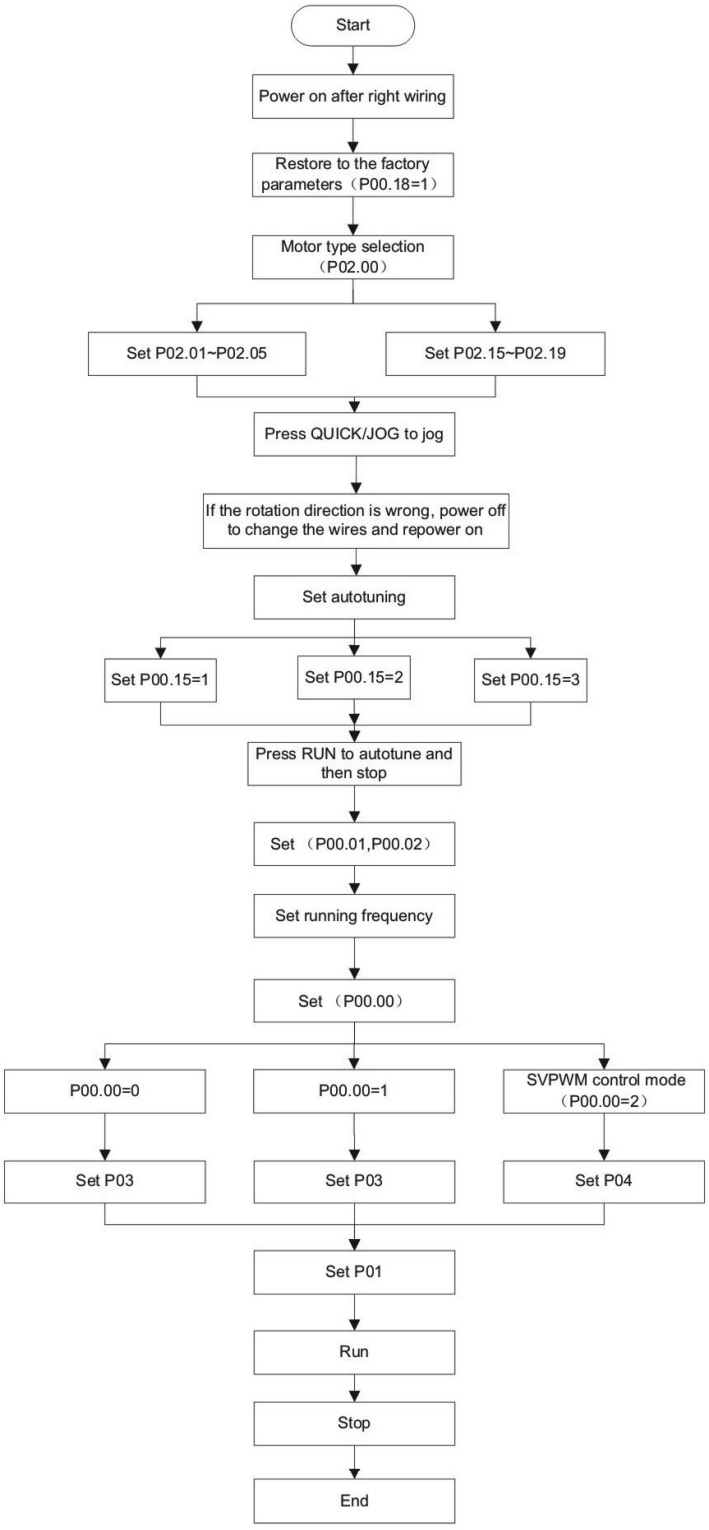

Note: If fault occurs, please do as the "Fault Tracking". Estimate the fault reason and settle the

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issue.

Besides P00.01 and P00.02, terminal command setting can also used to set the running command channel.

Current running command channel P00.01	Multi-function terminal 36 Shifting the command to keypad	Multi-function terminal 37 Shifting the command to communication	Multi-function terminal 38 Shifting the command to communication
Keypad running command channel	/	Terminal running command channel	Communication running command channel
Terminal running command channel	Keypad running command channel	/	Communication running command channel
Communication running command channel	Keypad running command channel	Terminal running command channel	/

Note: "/" means the multi-function terminal is invalid on the current reference channel.

Relative parameters table:

Function code	Name	Detailed instruction of parameters	Default value
P00.00	Speed control mode	1: SVC 2: SVPWM control (applying to AM)	2
P00.01	Run command channel	0:Keypad running command channel (LED off) 1:Terminal running command channel (LED flickering) 2:Communication running command channel (LED on)	0
P00.02	Communication running commands	0:MODBUS communication channel 1~ 3:Reserved	0
P00.18	Function restore parameter	0:No operation 1:Restore the default value 2:Clear fault records	0

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Function code	Name	Detailed instruction of parameters	Default value
P00.15	Motor parameter autotuning	0:No operation 1:Rotation autotuning 2:Static autotuning 1 3: Static autotuning 2	0
P00.17	Inverter type	0:G 1:P	0
P02.01	Rated power of AM 1	0.1~3000.0kW	Depend on model
P02.02	Rated frequency of AM 1	0.01Hz~P00.03(the Max. frequency)	50.00 Hz
P02.03	Rated speed of AM 1	1~36000rpm	Depend on model
P02.04	Rated voltage of AM 1	0~1200V	Depend on model
P02.05	Rated current of AM 1	0.8~6000.0A	Depend on model
P05.01~P05.09	Multi-function digital input terminals (S1~S8,HDI) function selection	36:Shift the command to the keypad 37:Shift the command to the terminals 38:Shift the command to the communication	
P07.01	Parameter copy	The function code determines the mode of parameters copy. 0:No operation 1:Upload the local function parameter to the keypad 2:Download the keypad function parameter to local address(including the motor parameters) 3:Download the keypad function parameter to local address (excluding the motor parameter of P02 group)	0

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Function code	Name	Detailed instruction of parameters	Default value
		4:Download the keypad function parameters to local address (only for the motor parameter of P02 group)	
P07.02	QUICK/JOG function selection	0:No function 1: Jogging 2: Shift the display state by the shifting key 3: Shift between forward rotations and reverse rotations 4: Clear UP/DOWN settings 5: Coast to stop 6: Shift the running commands source 7:Quick commission mode(committee according to the non-factory parameter)	1

7.3 Vector control

Because asynchronous motors have the characteristics of high stage, nonlinear, strong coupling and various variables, the actual control of the asynchronous motor is very difficult. Vector control is mainly used to settle this problem with the theme of that divide the stator current vector into exciting current (the current heft generating internal magnetic field of the motor) and torque current (the current heft generating torque) by controlling and measuring the stator current vector according to the principles of beamed magnetic field to control the range and phase of these two hefts. This method can realize the decoupling of exciting current and torque current to adjust the high performance of asynchronous motors.

Goodrive200 series inverters are embedded speedless sensor vector control calculation for driving both asynchronous motors and synchronous motors. Because the core calculation of vector control is based on exact motor parameter models, the accuracy of motor parameter will impact on the performance of vector control. It is recommended to input the motor parameters and carry out autotune before vector running.

Because the vector control calculation is vary complicated, high technical theory is needed for the user during internal autotune. It is recommended to use the specific function parameters in vector control with cautions.

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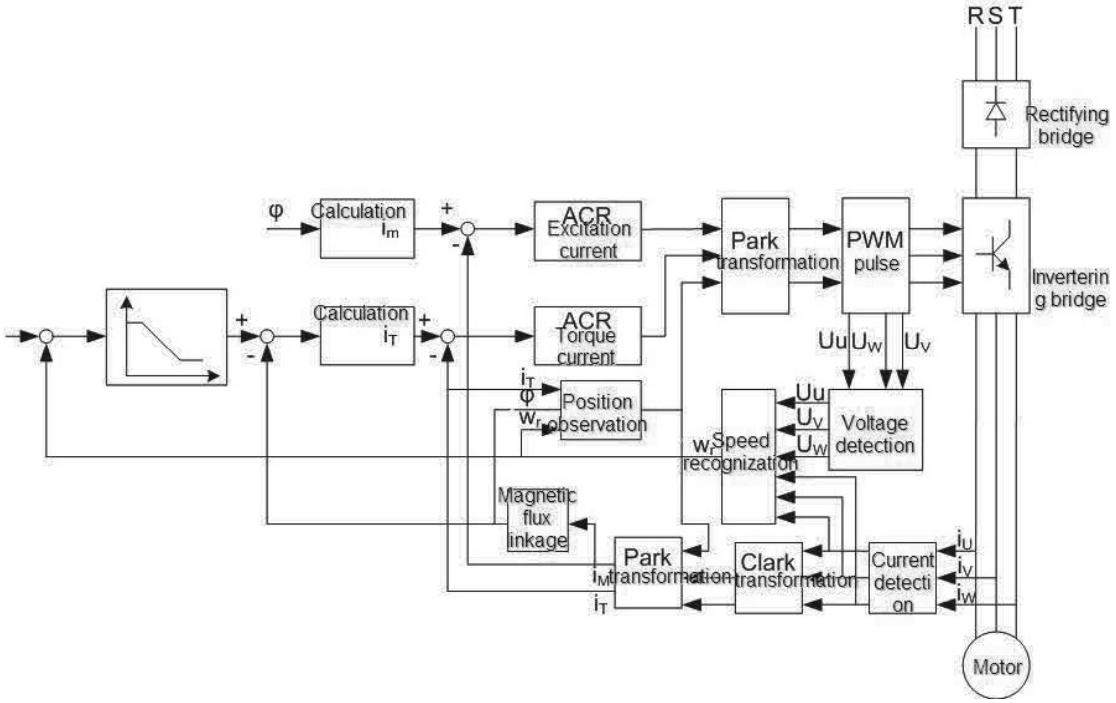

Function code	Name	Detailed instruction of parameters	Default value
P00.00	Speed control mode	1: SVC 2: SVPWM control (applying to AM)	2
P00.15	Motor parameter autotuning	0:No operation 1:Rotation autotuning 2: Static autotuning 1(autotune totally) 3: Static autotuning 2(autotune part parameters)	0
P02.00	Inverter type	0:G 1:P	0
P03.00	Speed loop proportional gain1	0~200.0	20.0
P03.01	Speed loop integral time1	0.000~10.000s	0.200s
P03.02	Low switching frequency	0.00Hz~P03.05	5.00Hz
P03.03	Speed loop proportional gain 2	0~200.0	20.0

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Function code	Name	Detailed instruction of parameters	Default value
P03.04	Speed loop integral time 2	0.000~10.000s	0.200s
P03.05	High switching frequency	P03.02~P00.03(the Max. frequency)	10.00Hz
P03.06	Speed loop output filter	0~8 (corresponds to 0~2^8/10ms)	0
P03.07	Compensation coefficient of electromotion slip	50%~200%	100%
P03.08	Compensation coefficient of braking slip	50%~200%	100%
P03.09	Current loop percentage coefficient P	0~65535	1000
P03.10	Current loop integral coefficient 1	0~65535	1000
P03.11	Torque setting method	1:Keypad setting torque(P03.12) 2:Analog AI1 setting torque 3:Analog AI2 setting torque 4:Analog AI3 setting torque 5:Pulse frequency HDI setting torque 6:Multi-step torque setting 7:MODBUS communication setting torque 8~10:Reserved	0
P03.12	Keypad setting torque	-300.0%~300.0% (rated current of the motor)	50.0%
P03.13	Torque reference filter time	0.000~10.000s	0.010s
P03.14	Upper frequency of forward rotation in vector control	0:Keypad (P03.16 sets P03.14,P03.17 sets P03.15) 1: AI1 2: AI2 3: AI3 4:Pulse frequency HDI setting upper-limit frequency	0
P03.15	Upper frequency of reverse rotation in vector control		0

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Function code	Name	Detailed instruction of parameters	Default value
		5:Multi-step setting upper-limit frequency 6:MODBUS communication setting upper-limit frequency 7~9: Reserved	
P03.16	Keypad setting for upper frequency of forward rotation	Setting range:0.00Hz~P00.03 (the Maximum frequency)	50.00Hz
P03.17	Keypad setting for upper frequency of reverse rotation		50.00Hz
P03.18	Upper electromotion torque source	0:Keypad setting upper-limit frequency(P03.20 sets P03.18, P03.21 sets P03.19)	0
P03.19	Upper braking torque source	1: AI1 2: AI2 3: AI3 4: HDI 5:MODBUS communication 6~8: Reserved	0
P03.20	Keypad setting of electromotion torque	0.0~300.0%(rated current of the motor)	180.0%
P03.21	Keypad setting of braking torque		180.0%
P03.22	Weakening coefficient in constant power zone	0.1~2.0	0.3
P03.23	Lowest weakening point in constant power zone	10%~100%	20%
P03.24	Max. voltage limit	0.0~120.0%	100.0%
P03.25	Pre-exciting time	0.000~10.000s	0.300s
P17.32	Magnetic flux linkage	0.0~200.0%	0

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7.4 SVPWM control

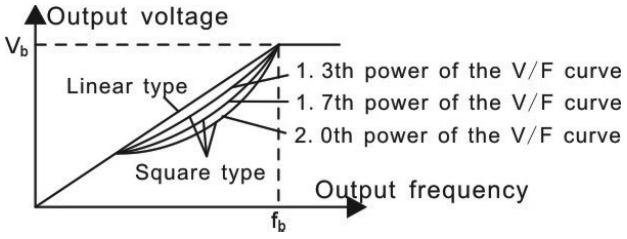
Goodrive200 series inverters provide internal SVPWM control which can be used in cases where it does not need high control accuracy. It is also recommended to use SVPWM control when one inverter drives multiple motors.

Goodrive200 series inverters provide multiple V/F curve modes. The user can select the corresponding V/F curve to the site needs. Or they can set the corresponding V/F curve to their own needs.

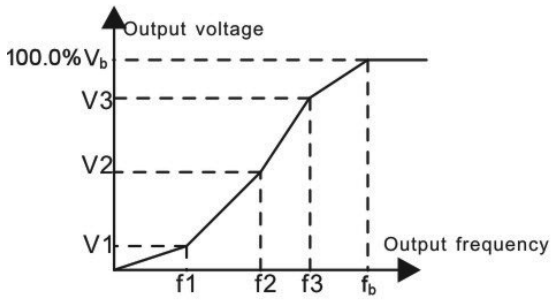
Recommendations:

For the load of constant torque, such as the conveyor belt which runs linearly. It is properly to select linear V/F curve because it needs constant torque.

For the load of decreasing torque, such as fans and water pumps, it is properly to select corresponding 1.3th, 1.7th or 2nd power of V/F curve because the actual torque is 2-squared or 3-squared of the rotating speed.



Goodrive200 series inverters provide multi-dots V/F curve, the user can change the output V/F curve by setting the voltage and frequency of three middle dots. The whole curve is consisted of 5 dots. The starting dot is (0Hz, 0V), and the ending dot is (the basic frequency of the motor, the rated voltage of the motor). During the setting processing: $0 \le f_1 \le f_2 \le f_3 \le$ the basic frequency of the motor; $0 \le V_1 \le V_2 \le V_3 \le$ the rated voltage of the motor.



Goodrive200 series inverters provide special function code for SVPWM control mode which can improve the performance of SVPWM control by means of setting.

1. Torque boost

Torque boost function can compensate the performance of low speed torque during SVPWM

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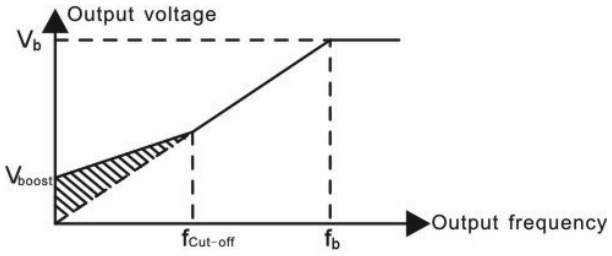
control. The inverter will adjust the torque boost according to the actual load.

Note:

The torque boost takes effect only when the frequency is under the cap frequency of the boost.

If the torque boost is too big, low frequency vibration or overcurrent fault may occur. Please lower the torque boost.



2. Energy-saving running

In the actual operation, the inverter can search by itself to achieve a better effect point. The inverter can work with high effect to save energy.

Note:

This function is usually used in the cases where the load is light or empty.

If the load transients frequently, this function is not appropriate to be selected.

3. V/F slips compensation gain

SVPWM control belongs to the open loop mode. If the load of the motor transients suddenly, the fluctuation of the rotation speed may occur. In the cases where the high accuracy speed is needed, slip compensation gain (internal output adjustment) can be set to compensate the speed change caused by load fluctuation.

Setting range of slip compensation gain: 0~200%, of which 100% corresponds to the rated slip frequency.

Note: Rated slip frequency= (rated synchronous rotation speed of the motor-rated rotation speed of the motor) *number of pole pairs/60.

4. Vibration control

Motor vibration occurs frequently when applying SVPWM control mode in the cases where high power is needed. In order to settle this problem, Goodrive200 series inverters add two function codes which are set to control the vibration factors. The user can set the corresponding function code according to the vibration frequency.

Note: Bigger the set value, more effective is the control. If the set value is too big, overcurrent may occur to the motor.

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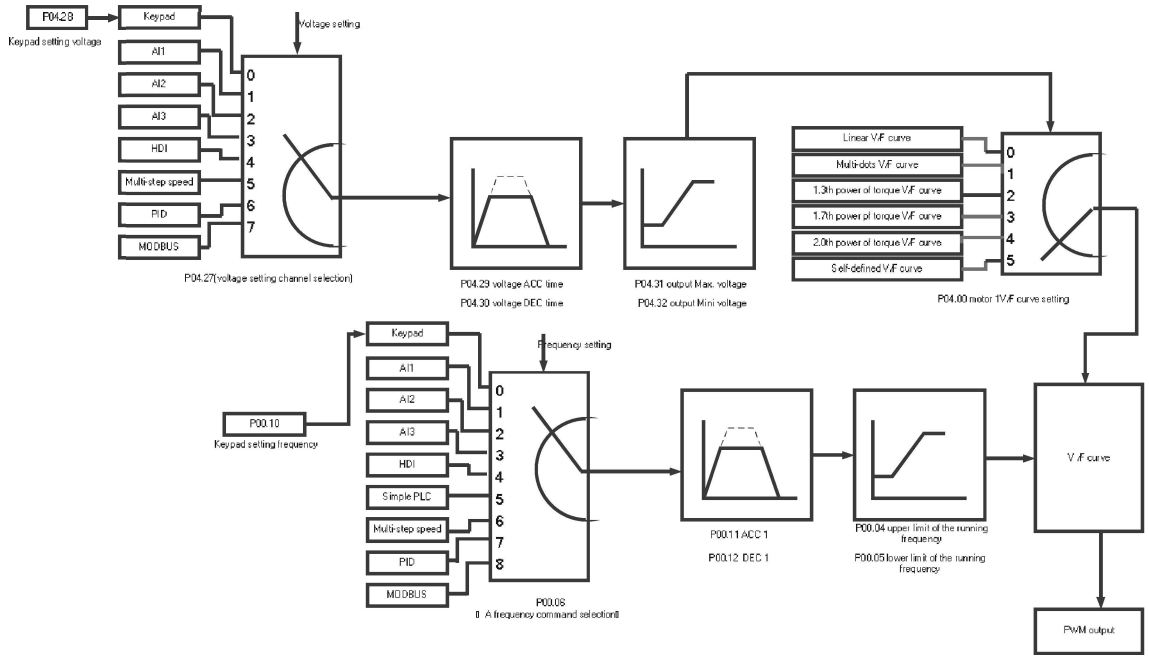

When the user selects the user-defined V/F curve function in Goodrive200 series inverters, they can set the reference channel of voltage and frequency and the corresponding ACC/DEC time, or the two can combination to form a real-time curve.

Note: the application of V/F curve separation can be used in many cases with various kinds of power supply of the inverter. But the users should set and adjust the parameters with caution. Incorrect parameters may cause damage to the inverter.

Function code	Name	Detailed instruction of parameters	Default value
P00.00	Speed control mode	1: SVC 2: SVPWM control (applying to AM)	2
P00.03	Max. output frequency	P00.04~400.00Hz	50.00Hz
P00.04	Upper limit of the running frequency	P00.05~P00.03	50.00Hz
P00.05	Lower limit of the running frequency	0.00Hz~P00.04	0.00Hz
P00.11	ACC time 1	0.0~3600.0s	Depend

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Function code	Name	Detailed instruction of parameters	Default value
			on model
P00.12	DEC time 1	0.0~3600.0s	Depend on model
P02.02	Rated frequency of AM 1	0.01Hz~P00.03(the Max. frequency)	50.00 Hz
P02.04	Rated voltage of AM 1	0~1200V	380V
P04.00	Motor 1 V/F curve setting	0:Straight line V/F curve; applying to the constant torque load 1:Multi-dots V/F curve 2:1.3th power low torque V/F curve 3:1.7th power low torque V/F curve 4:2.0th power low torque V/F curve 5:Customized V/F(V/F separation)	0
P04.01	Motor 1 torque boost	0.0%:(automatic)0.1%~10.0%	0.0%
P04.02	Motor 1 torque boost close	0.0%~50.0% (the rated frequency of motor 1)	20.0%
P04.03	V/F frequency 1 of motor 1	0.00Hz~P04.05	0.00Hz
P04.04	V/F voltage 1 of motor 1	0.0%~110.0%	00.0%
P04.05	V/F frequency 2 of motor 1	P04.03~ P04.07	00.00Hz
P04.06	V/F voltage 2 of motor 1	0.0%~110.0%	00.0%
P04.07	V/F frequency 3 of motor 1	P04.05~ P02.02	00.00Hz
P04.08	V/F voltage 3 of motor 1	0.0%~110.0%	00.0%
P04.09	V/F slip compensation gain of motor 1	0.0~200.0%	0.0%
P04.10	Motor 1 low frequency vibration control factor	0~100	10
P04.11	Motor 1 high frequency vibration control factor	0~100	10
P04.12	Motor 1 vibration control threshold	0.00Hz~P00.03 (the Max. frequency)	30.00 Hz
P04.26	Energy-saving operation	0: No action	0

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Function code	Name	Detailed instruction of parameters	Default value
	selection	1: Automatic energy-saving running	
P04.27	Voltage setting channel	0: Keypad setting voltage: the output voltage is determined by P04.28. 1:AI1 setting voltage; 2:AI2 setting voltage; 3:AI3 setting voltage; 4:HDI setting voltage; 5:Multi-step speed setting voltage; 6:PID setting voltage; 7:MODBUS communication setting voltage; 8~10: Reserved	0
P04.28	Keypad setting voltage	0.0%~100.0% (the rated voltage of motor)	100.0%
P04.29	Voltage increasing time	0.0~3600.0s	5.0s
P04.30	Voltage decreasing time	0.0~3600.0s	5.0s
P04.31	Maximum output voltage	P04.32~100.0% (the rated voltage of motor)	100.0%
P04.32	Minimum output voltage	0.0%~P04.31(the rated voltage of motor)	0.0%

7.5 Torque control

Goodrive200 series inverters support two kinds of control mode: torque control and rotation speed control. The core of rotation speed is that the whole control focuses on the stable speed and ensures the setting speed is the same as the actual running speed. The Max. Load sould be in the range of the torque limit. The core of torque control is that the whole control focues on the stable torque and ensures the setting torque is the same as the actual output torque. At the same time, the output frequency is among the upper limit or the lower limit.

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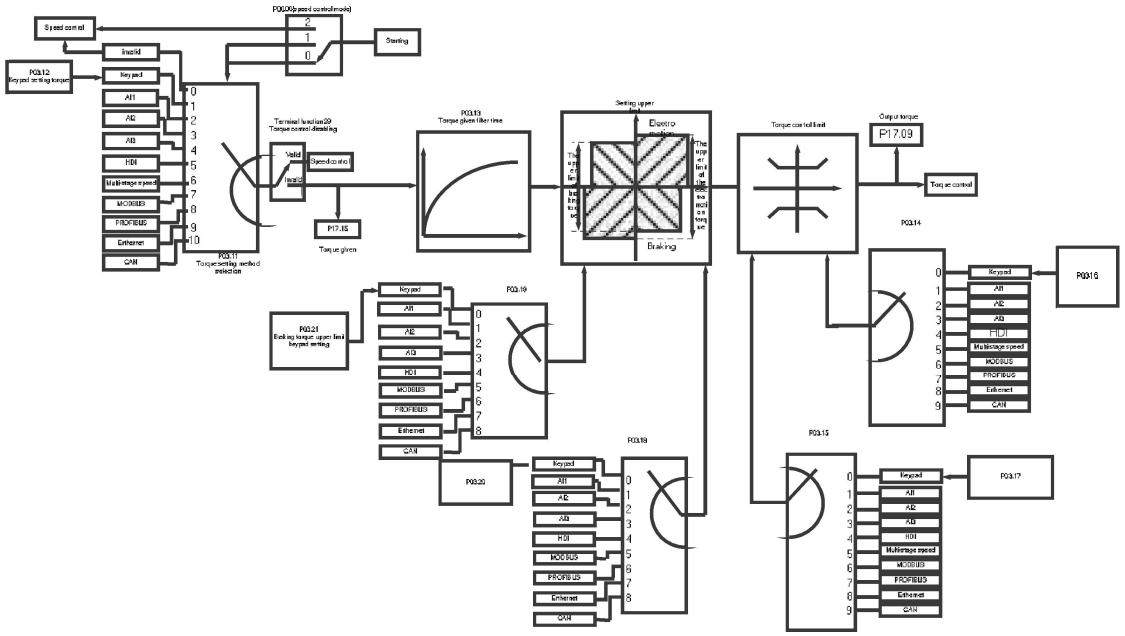

Function code	Name	Detailed instruction of parameters	Default value
P00.00	Speed control mode	1: SVC 2: SVPWM control (applying to AM)	2
P03.11	Torque setting method	0:Torque control is invalid 1:Keypad setting torque(P03.12) 2:Analog AI1 setting torque 3:Analog AI2 setting torque 4:Analog AI3 setting torque 5:Pulse frequency HDI setting torque 6:Multi-step torque setting 7:MODBUS communication setting torque 8~10:Reserved	0
P03.12	Keypad setting torque	-300.0%~300.0% (the rated current of the motor)	50.0%
P03.13	Torque reference filter time	0.000~10.000s	0.010s
P03.14	Upper frequency of forward rotation in vector control	0:Keypad (P03.16 sets P03.14,P03.17 sets P03.15) 1: AI1	0
P03.15	Upper frequency of	2: AI2	0

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Function code	Name	Detailed instruction of parameters	Default value
	reverse rotation in vector control	3: AI3 4:Pulse frequency HDI setting upper-limit frequency 5:Multi-step setting upper-limit frequency 6:MODBUS communication setting upper-limit frequency 7~9: Reserved	
P03.16	Keypad setting for upper frequency of forward rotation	0.00Hz~P00.03 (the Max. frequency)	50.00 Hz
P03.17	Keypad setting for upper frequency of reverse rotation	0.00 Hz~P00.03 (the Max. frequency)	50.00 Hz
P03.18	Upper electromotion torque source	0:Keypad setting upper-limit frequency(P03.20 sets P03.18, P03.21 sets P03.19) 1: AI1 2: AI2 3: AI3 4: HDI 5:MODBUS communication 6~8: Reserved	0
P03.19	Upper braking torque source		0
P03.20	Keypad setting of electromotion torque	0.0~300.0%(rated current of the motor)	180.0%
P03.21	Keypad setting of braking torque	0.0~300.0%(rated current of the motor)	180.0%
P17.09	Output torque	-250.0~250.0%	0.0%
P17.15	Torque reference	-300.0~300.0%(rated current of the motor)	0.0%

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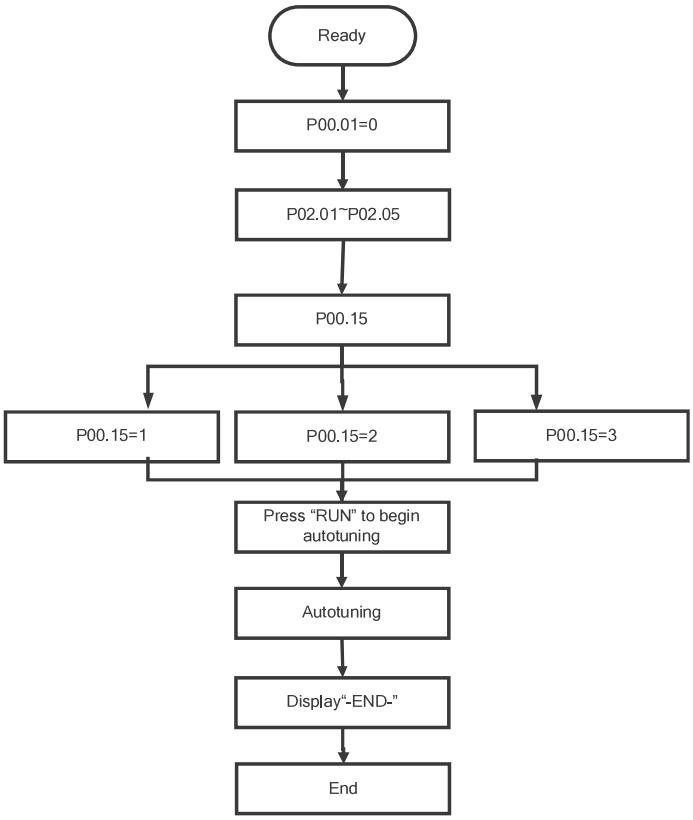
7.6 Parameters of the motor

	✧**Physical accident may occur if the motor starts up suddenly during autotune. Please check the safety of surrounding environment of the motor and the load before autotune.** ✧**The power is still applied even the motor stops running during static autotune. Please do not touch the motor until the autotune is completed, otherwise there would be electric shock.**
	✧**Do not carry out the rotation autotune if the motor is coupled with the load, please do not operate on the rotation autotune. Otherwise misaction or damage may occur to the inverter or the mechanical devices. When carry out autotune on the motor which is coupled with load, the motor parameter won't be counted correctly and misaction may occur. It is proper to de-couple the motor from the load during autotune when necessary.**



The control performance of the inverter is based on the established accurate motor model. The user has to carry out the motor autotune before first running (take motor 1 as the example).

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Note:

1. Set the motor parameters according to the name plate of the motor.

2. During the motor autotune, de-couple the motor form the load if rotation autotune is selected to make the motor is in a static and empty state, otherwise the result of autotune is incorrect. The asynchronous motors can autotune the parameters of P02.06~P02.10.

3. During the motor autotune 1, do not to de-couple the motor form the load if static autotune is selected. Because only some parameters of the motor are involved, the control performance is not as better as the rotation autotune. The asynchronous motors can autotune the parameters of P02.06~P02.10.

4. During the motor autotune 2, do not to de-couple the motor form the load if static autotune is selected. Because only some parameters of the motor are involved, the control performance is not as better as the rotation autotune. The asynchronous motors can autotune the parameters of P02.06~P02.08. It is suitable in the cases which SVPWM control is applied.

Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P00.01	Run command channel	0:Keypad running command channel(LED off) 1:Terminal running command channel (LED flickering) 2:Communication running command channel (LED on)	0
P00.15	Motor parameter autotuning	0:No operation 1:Rotation autotuning 2:Static autotuning 1 3:Static autotuning 2	0
P00.17	Inverter type	0:G 1:P	0
P02.01	Rated power of AM 1	0.1~3000.0kW	Depend on model
P02.02	Rated frequency of AM 1	0.01Hz~P00.03(the Max frequency)	50.00Hz
P02.03	Rated speed of AM 1	1~36000rpm	Depend on model

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Function code	Name	Detailed instruction of parameters	Default value
P02.04	Rated voltage of AM 1	0~1200V	Depend on model
P02.05	Rated current of AM 1	0.8~6000.0A	Depend on model
P02.06	Stator resistor of AM 1	0.001~65.535Ω	Depend on model
P02.07	Rotor resistor of AM 1	0.001~65.535Ω	Depend on model
P02.08	Leakage inductance of AM 1	0.1~6553.5mH	Depend on model
P02.09	Mutual inductance of AM 1	0.1~6553.5mH	Depend on model
P02.10	Non-load current of AM 1	0.1~6553.5A	Depend on model

7.7 Start-up and stop control

The start-up and stop control of the inverter includes three states: start after the running command during normal powering on, start after the restarting function becomes valid during normal powering on and start after the automatic fault reset. Below is the detailed instruction for three starting.

There are three starting modes for the inverter: start from the starting frequency directly, start after the DC braking and start after the rotation speed tracking. The user can select according to different situations to meet their needs.

For the load with big inertia, especially in the cases where the reverse rotation may occur, it is better to select starting after DC braking and then starting after rotation speed tracking.

1. The starting logic figure of starting after the running command during the normal powering on

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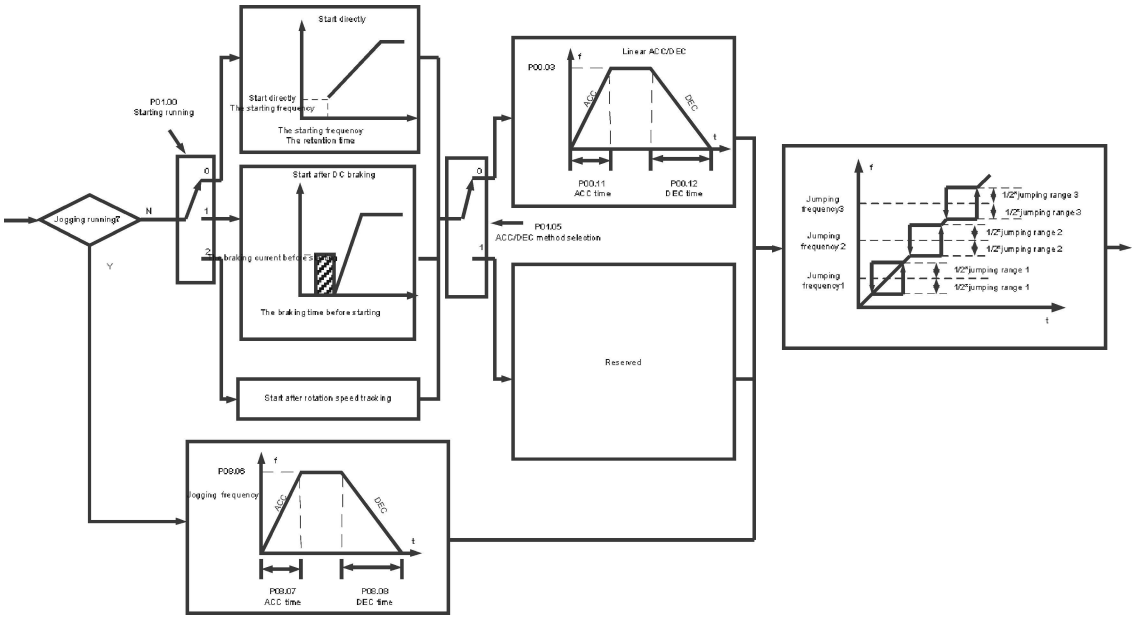
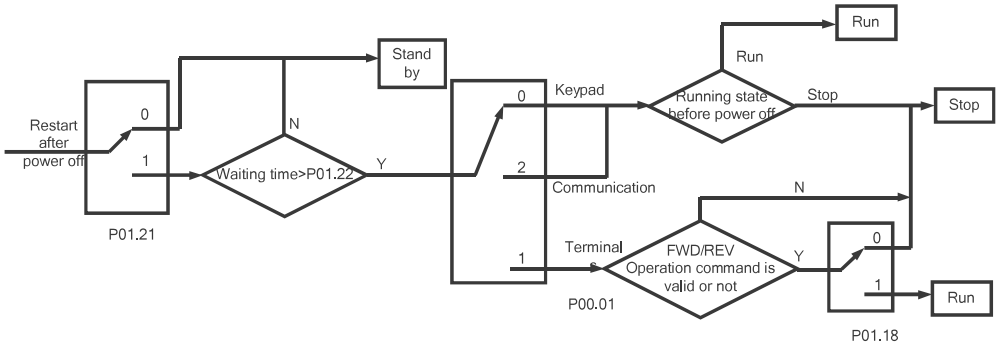


2. The starting logic figure of starting after the restarting function becomes valid during the normal powering on



3. The starting logic figure of starting after the automatic fault reset

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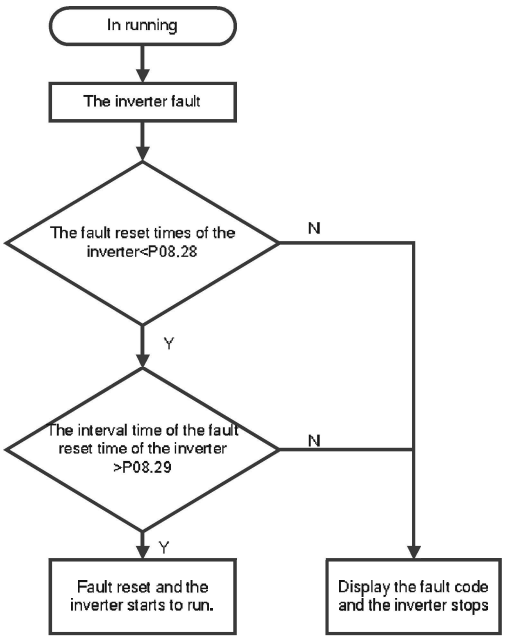

Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P00.01	Run command channel	0:Keypad running command channel(LED off) 1:Terminal running command channel (LED flickering) 2:Communication running command channel (LED on)	0
P00.11	ACC time 1	0.0~3600.0s	Depend on model
P00.12	DEC time 1	0.0~3600.0s	Depend on model
P01.00	Start mode	0:Start-up directly 1:Start-up after DC braking 2: Start-up after speed tracking	0
P01.01	Starting frequency of direct start	0.00~50.00Hz	0.50Hz
P01.02	Retention time of the starting frequency	0.00~50.00s	0.00s

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Function code	Name	Detailed instruction of parameters	Default value
P01.03	The braking current before starting	0.0~100.0%	0.0%
P01.04	The braking time before starting	0.00~50.00s	0.00s
P01.05	ACC/DEC selection	0:Linear type 1:Reserved	0
P01.08	Stop mode	0:Decelerate to stop 1:Coast to stop	0
P01.09	Starting frequency of DC braking	0.00Hz~P00.03(the Max. frequency)	0.00Hz
P01.10	Waiting time before DC braking	0.00~50.00s	0.00s
P01.11	DC braking current	0.0~150.0%	0.0%
P01.12	DC braking time	0.00~50.00s	0.00s
P01.13	Dead time of FWD/REV rotation	0.0~3600.0s	0.0s
P01.14	Shifting between FWD/REV rotation	0:Switch after 0 frequency 1:Switch after the starting frequency 2:Switch after the stopping speed	0
P01.15	Stopping speed	0.00~100.00Hz	0.50 Hz
P01.19	Action selection (operation frequency<lower frequency limit and valid when the lower limit >0)	0: Run at the lower-limit frequency 1: Stop 2: Hibernation	0
P01.20	Hibernation restore delay time	0.0~3600.0s(valid when P01.15=2)	0.0s
P01.21	Restart after power off	0: Disable 1: Enable	0
P01.22	The waiting time of restart after power off	0.0~3600.0s(valid when P01.21=1)	1.0s

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Function code	Name	Detailed instruction of parameters	Default value
P01.23	Start delay time	0.0~60.0s	0.0s
P01.24	Delay time of the stop speed	0.0~10.0 s	0.0s
P05.01~P05.09	Digital input function selection	1: Forward rotation operation 2: Reverse rotation operation 4: Forward rotation jogging 5: Reverse rotation jogging 6: Coast to stop 7: Fault reset 8: Operation pause 21:ACC/DEC time option1 22:ACC/DEC time option2 30:ACC/DEC prohibition	
P08.06	Jogging frequency	0.00~P00.03(the Max. frequency)	5.00Hz
P08.07	Jogging ACC time	0.0~3600.0s	Depend on model
P08.08	Jogging DEC time	0.0~3600.0s	Depend on model
P08.00	ACC time 2	0.0~3600.0s	Depend on model
P08.01	DEC time 2	0.0~3600.0s	Depend on model
P08.02	ACC time 3	0.0~3600.0s	Depend on model
P08.03	DEC time 3	0.0~3600.0s	Depend on model
P08.04	ACC time 4	0.0~3600.0s	Depend on model
P08.05	DEC time 4	0.0~3600.0s	Depend on model
P08.28	Fault reset times	0~10	0

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Function code	Name	Detailed instruction of parameters	Default value
P08.29	Interval time of automatic fault reset	0.1~3600.0s	1.0s

7.8 Frequency setting

Goodrive200 series inverters can set the frequency by various means. The reference channel can be divided into main reference channel and assistant reference channel.

There are two main reference channels: A frequency reference channel and B frequency reference channel. These two reference channels can carry out mutual simple math calculation between each other. And the reference channels can be shifted dynamically through set multi- function terminals.

There are three assistant reference channels: keypad UP/DOWN input, terminals UP/DOWN switch input and digital potentiometer input. The three ways equal to the effect of input UP/DOWN reference in internal assistant reference of the inverter. The user can enable the reference method and the effect of the method to the frequency reference by setting function codes.

The actual reference of the inverter is consisted of main reference channel and assistant reference channel.

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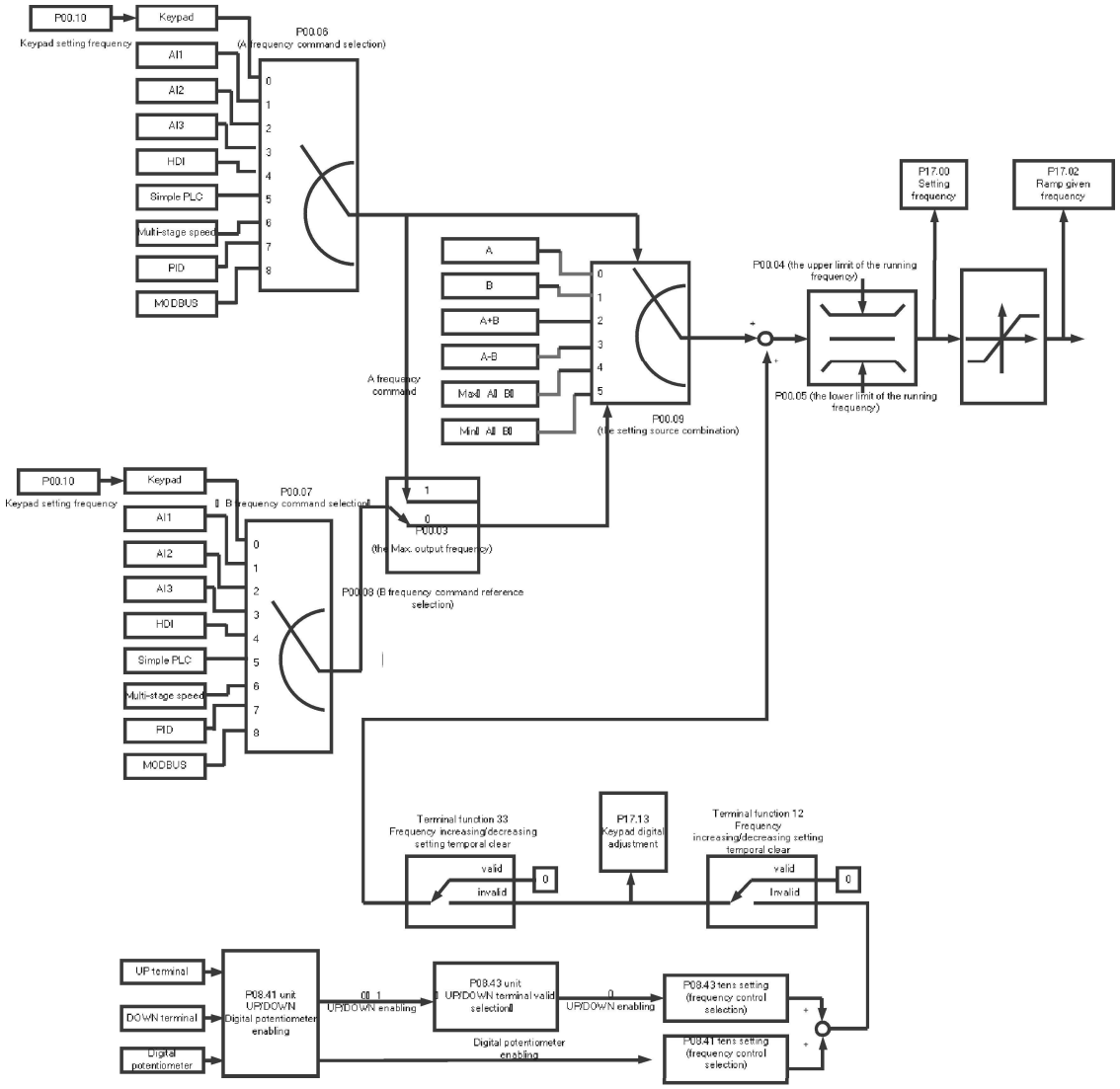

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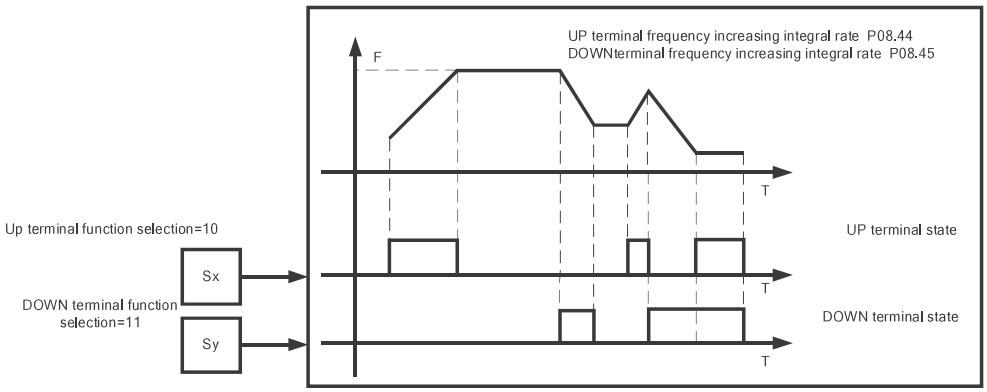
Goodrive200 series inverters support the shifting between different reference channels and the detailed shifting rules is as below:

Current reference channel P00.09	Multi-function terminal function 13 Shifting from A channel to B channel	Multi-function terminal function 14 Shifting from combination setting to A channel	Multi-function terminal function 15 Shifting from combination setting to B channel
A	B	/	/
B	A	/	/
A+B	/	A	B
A-B	/	A	B
Max(A,B)	/	A	B
Min(A,B)	/	A	B

Note: "/" means the multi-function terminal is invalid under the current reference channel.

When select multi-function terminal UP (10) and DOWN (11) to set the internal assistant frequency, P08.44 and P08.45 can be set to increase or decrease the set frequency quickly.



Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P00.03	Max. output frequency	P00.04~400.00Hz	50.00Hz
P00.04	Upper limit of the running frequency	P00.05~P00.03	50.00Hz

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Function code	Name	Detailed instruction of parameters	Default value
P00.05	Lower limit of the running frequency	0.00Hz~P00.04	0.00Hz
P00.06	A frequency command	0:Keypad data setting 1:Analog AI1 setting 2:Analog AI2 setting 3:Analog AI3 setting 4:High-speed pulse HDI setting 5:Simple PLC program setting 6: Multi-step speed running setting 7: PID control setting 8:MODBUS communication setting 9~11:Reserved	0
P00.07	B frequency command	0:Keypad data setting 1:Analog AI1 setting 2:Analog AI2 setting 3:Analog AI3 setting 4:High-speed pulse HDI setting 5:Simple PLC program setting 6: Multi-step speed running setting 7: PID control setting 8: MODBUS communication setting 9~11: Reserved	2
P00.08	B frequency command reference	0: The Max. output frequency 1: A frequency command	0
P00.09	Combination of the setting source	0:A 1:B 2:(A+B)combination 3:(A-B)combination 4:Max(A,B)combination 5:Min(A,B)combination	0
P05.01~P05.09	Multi-function digital input terminals	10:Increasing frequency setting(UP) 11:Decreasing frequency	

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Function code	Name	Detailed instruction of parameters	Default value
	(S1~S8,HDI) function selection	setting(DOWN) 12:Cancel the frequency change setting 13:Shift between A setting and B setting 14:Shift between combination setting and A setting 15:Shift between combination setting and B setting	
P08.42	Keypad data control	0x000~0x1223 LED ones:frequency enable selection 0:Both ∧/∨ keys and digital potentiometer adjustments are valid 1:Only ∧/∨ keys adjustment is valid 2:Only digital potentiometer adjustments is valid 3:Neither ∧/∨ keys nor digital potentiometer adjustments are valid LED tens: frequency control selection 0:Only valid when P00.06=0 or P00.07=0 1:Valid for all frequency setting manner 2:Invalid for multi-step speed when multi-step speed has the priority LED hundreds: action selection during stopping 0:Setting is valid 1:Valid during running, cleared after stopping 2:Valid during running, cleared after receiving the stop command LED thousands: ∧/∨ keys and digital potentiometer integral function 0:The integral function is valid 1:The integral function is invalid	0x0000

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Function code	Name	Detailed instruction of parameters	Default value
P08.43	Keypad data potentiometer integral ratio	0.01~10.00s	0.10s
P08.44	UP/DOWN terminals control	0x00~0x221 LED ones: frequency control selection 0:UP/DOWN terminals setting valid 1:UP/DOWN terminals setting valid LED tens: frequency control selection 0:Only valid when P00.06=0 or P00.07=0 1:All frequency means are valid 2:When the multi-step are priority, it is invalid to the multi-step LED hundreds: action selection when stop 0:Setting valid 1: Valid in the running, clear after stop 2: Valid in the running, clear after receiving the stop commands	0x000
P08.45	UP terminals frequency increasing integral ratio	0.01~50.00Hz/s	0.50 Hz/s
P08.46	DOWN terminals frequency integral ratio	0.01~50.00 Hz/s	0.50 Hz/s
P17.00	Set frequency	0.00Hz~P00.03 (the Max. output frequency)	0.00Hz
P17.02	Ramp reference frequency	0.00Hz~P00.03 (the Max. output frequency)	0.00Hz
P17.14	Digital adjustment	0.00Hz~P00.03	0.00Hz

7.9 Analog input

Goodrive200 series inverters have three analog input terminals and 1 high-speed pulse input terminals (of which, AI1 and AI2 are 0~10V/0~20mA and AI can select voltage input or current input by J3, AI2 can select voltage input or current input by J4 and AI3 is for -10~10V) as the standard configuration. The inputs can be filtered and the maximum and minimum values can be adjusted.

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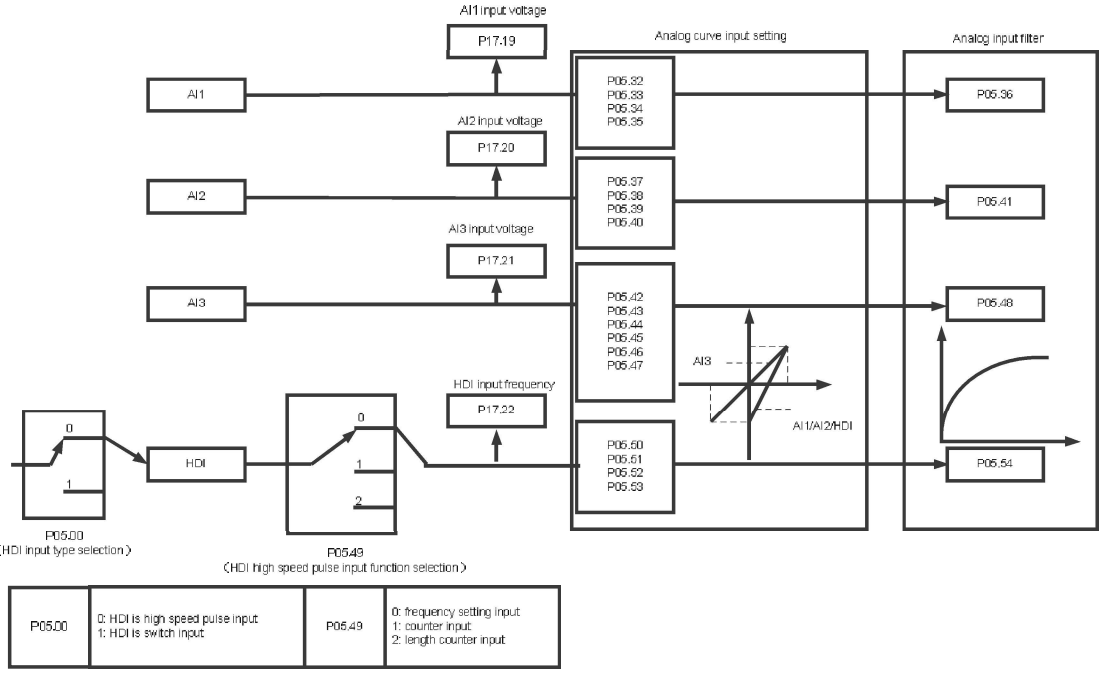

Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P05.00	HDI input selection	0: HDI is high pulse input 1: HDI is switch input	0
P05.32	Lower limit of AI1	0.00V~P05.25	0.00V
P05.33	Corresponding setting of the lower limit of AI1	-100.0%~100.0%	0.0%
P05.34	Upper limit of AI1	P05.23~10.00V	10.00V
P05.35	Corresponding setting of the upper limit of AI1	-100.0%~100.0%	100.0%
P05.36	AI1 input filter time	0.000s~10.000s	0.100s
P05.37	Lower limit of AI2	0.00V~P05.30	0.00V
P05.38	Corresponding setting of the lower limit of AI2	-100.0%~100.0%	0.0%
P05.39	Upper limit of AI2	P05.28~10.00V	10.00V
P05.40	Corresponding setting of	-100.0%~100.0%	100.0%

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Function code	Name	Detailed instruction of parameters	Default value
	the upper limit of AI2		
P05.41	AI2 input filter time	0.000s~10.000s	0.100s
P05.42	Lower limit of AI3	-10.00V~P05.35	-10.00V
P05.43	Corresponding setting of the lower limit of AI3	-100.0%~100.0%	-100.0%
P05.44	Middle value of AI3	P05.33~P05.37	0.00V
P05.45	Corresponding middle setting of AI3	-100.0%~100.0%	0.0%
P05.46	Upper limit of AI3	P05.35~10.00V	10.00V
P05.47	Corresponding setting of the upper limit of AI3	-100.0%~100.0%	100.0%
P05.48	AI3 input filter time	0.000s~10.000s	0.100s
P05.49	HDI high-speed pulse input function selection	0:Fquency setting input 1:Counter input 2:Length counting input	0
P05.50	Lower limit frequency of HDI	0.000kHz ~ P05.43	0.000 kHz
P05.51	Corresponding setting of HDI low frequency setting	-100.0%~100.0%	0.0%
P05.52	Upper limit frequency of HDI	P05.41 ~50.000kHz	50.000 kHz
P05.53	Corresponding setting of upper limit frequency of HDI	-100.0%~100.0%	100.0%
P05.54	HDI frequency input filter time	0.000s~10.000s	0.100s

7.10 Analog output

Goodrive200 series inverters have 2 analog output terminals (0~10V or 0~20mA) and 1 high speed pulse output terminal. Analog output signals can be filtered separately and the maximum and

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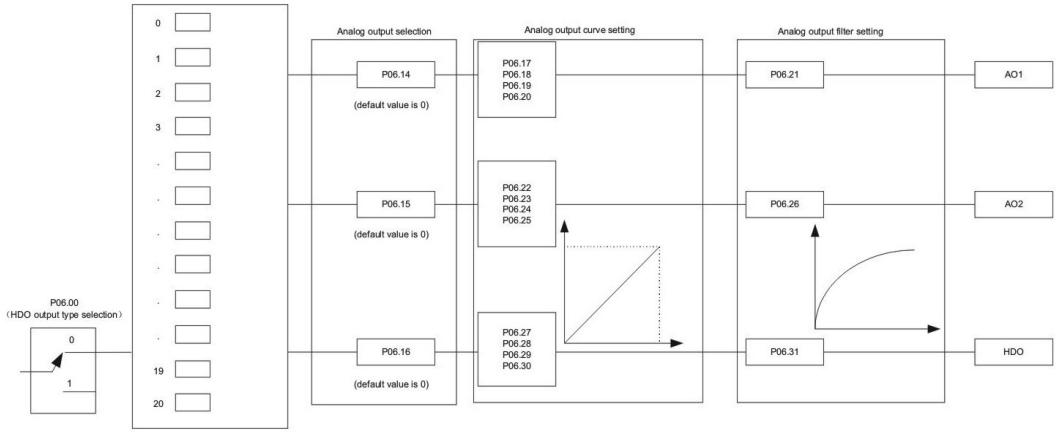
minimum values can be adjusted. The analog output signals can be proportional to motor speed, output frequency, output current, motor torque, motor power, etc.



P06.00	0: open collector high speed pulse output 1: open collector output

P06.01、P06.02、P06.03、P06.04 output selection

0	Running frequency	1	Set frequency	2	Ramp given frequency
3	Running rotation speed	4	Output current (relative to the inverter)	5	Output current (relative to the motor)
6	Output voltage	7	Output power	8	Set torque
9	Output torque	10	Analog AI1 input value	11	Analog AI2 input value
12	Analog AI3 input value	13	HDI input value	14	MODBUS communication setting 1
15	MODBUS communication setting 2	16	PROFIBUS communication setting 1	17	PROFIBUS communication setting 1
18	Torque current (relative to the nominal current of the motor)	19	Exciting current (relative to the nominal current of the motor)	20	Reserved

Output instructions:

Set value	Function	Instructions
0	Running frequency	0~the Max. output frequency
1	Set frequency	0~ the Max. output frequency
2	Ramp reference frequency	0~ the Max. output frequency
3	Running rotation speed	0~2 times of the rated synchronous rotation speed of the motor
4	Output current (relative to the inverter)	0~2 times of the rated current of the inverter
5	Output current (relative to the motor)	0~2 times of the rated current of the inverter
6	Output voltage	0~1.5 times of the rated voltage of the inverter
7	Output power	0~2 times of the rated power
8	Setting torque	0~2 times of the rated current of the motor

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Set value	Function	Instructions
9	Output torque	0~2 times of the rated current of the motor
10	AI1	0~10V/0~20mA
11	AI2	0~10V/0~20mA
12	AI3	-10V~10V
13	HDI	0.00~50.00kHz
14	MODBUS communication set value 1	-1000~1000,1000 corresponds to 100.0%
15	MODBUS communication set value 2	-1000~1000,1000 corresponds to 100.0%
16~21	Reserved	
22	Torque current (the rated current of the motor)	0~2 times of the rated current of the motor
23	Ramp reference frequency(with sign)	0~ the Max. output frequency
24~30	Reserved	

Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P06.00	HDO output	0:Open collector pole high speed pulse output 1: Open collector pole output	0
P06.14	AO1 output	0:Running frequency 1:Set frequency 2:Ramp reference frequency 3:Running rotation speed 4:Output current (relative to the rated current of the inverter) 5:Output current(relative to the rated current of the motor) 6:Output voltage 7:Output power 8:Set torque value	0
P06.15	AO2 output		0
P06.16	HDO high-speed pulse output selection		0

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Function code	Name	Detailed instruction of parameters	Default value
		9:Output torque 10:Analogy AI1 input value 11:Analogy AI2 input value 12:Analogy AI3 input value 13:High speed pulse HDI input value 14:MODBUS communication set value 1 15:MODBUS communication set value 2 16~21:Reserved 22: Torque current (the rated current of the motor) 23: Ramp reference frequency(with sign) 24~30: Reserved	
P06.17	Lower limit of AO1 output	0.0%~P06.15	0.0%
P06.18	Corresponding AO1 output to the lower limit	0.00V~10.00V	0.00V
P06.19	Upper limit of AO1 output	P06.13~100.0%	100.0%
P06.20	The corresponding AO1 output to the upper limit	0.00V~10.00V	10.00V
P06.21	AO1 output filter time	0.000s~10.000s	0.000s
P06.22	Lower limit of AO2 output	0.0%~P06.20	0.0%
P06.23	Corresponding AO2 output to the lower limit	0.00V~10.00V	0.00V
P06.24	Upper limit of AO2 output	P06.18~100.0%	100.0%
P06.25	Corresponding AO2 output to the upper limit	0.00V~10.00V	10.00V
P06.26	AO2 output filter time	0.000s~10.000s	0.000s
P06.27	Lower limit of HDO output	0.0%~P06.25	0.00%
P06.28	Corresponding HDO output to the lower limit	0.00~50.00kHz	0.0kHz
P06.29	Upper limit of HDO output	P06.23~100.0%	100.0%
P06.30	Corresponding HDO	0.00~50.00kHz	50.00kHz

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Function code	Name	Detailed instruction of parameters	Default value
	output to the upper limit		
P06.31	HDO output filter time	0.000s~10.000s	0.000s

7.11 Digital input

Goodrive200 series inverters have 8 programmable digital input terminals and 1 open-collector input terminal in the standard configuration. All functions of the digital input terminals are programmable by the function codes. Open collector pole input can be selected into high speed pulse input terminal or common switch input terminal by function code. When selected into HDI, the user can select HDI high speed pulse input as frequency reference, counting input or length pulse input by setting.

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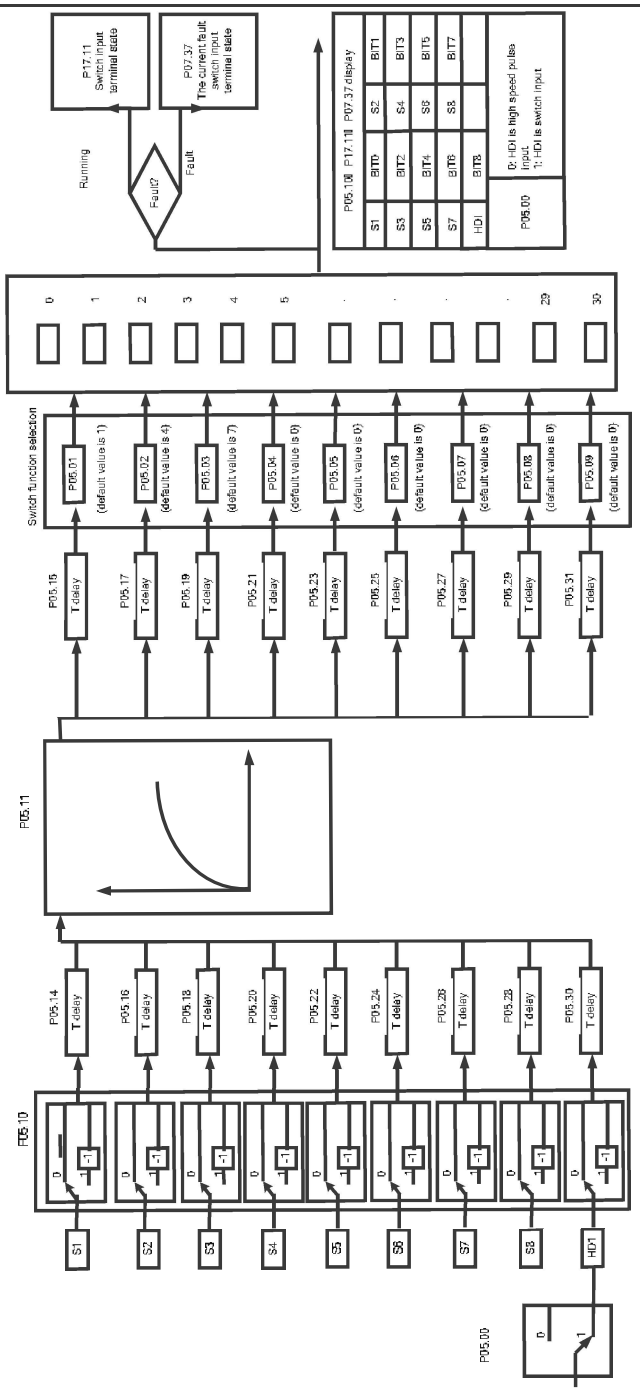

These parameters are used to set the function corresponds to the digital multi-function terminals.

Note: two different multi-function terminals can not be set as one function.

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Set value	Function	Instructions
0	No function	The inverter does not work even there is input signal. It is necessary to set the terminal which can not be used to non-function to avoid misacting.
1	Forward running(FWD)	The forward or reverse rotation of the inverter can be controlled by the external terminals.
2	Reverse running(REV)	
3	3-wire running control	The terminal can determine the running mode of the inverter is 3-wire control mode. Refer to P05.13 for detailed instruction of 3-wire control mode.
4	Forward jogging	See P08.06, P08.07 and P08.08 for jogging frequency, jogging ACC/DEC time.
5	Reverse jogging	
6	Coast to stop	The inverter closes off the output. The motor is not controlled by the inverter during the stopping. This method is usually to be used when the load inertia is big and it has no requirement to the stopping time. It has the same meaning with the “coast to stop” in P01.08 and usually used in remote control.
7	Fault reset	External fault reset. It has the same function with the reset function of STOP/RST on the keypad. This function can realize remote fault reset.
8	Operation pause	The inverter decelerates to stop. But all running parameters are in the memory state. For example, PLC parameters, traverse parameters and PID parameters. After the signal disappears, the inverter will come back to the state before stopping.
9	External fault input	When the external fault signal is sent to the inverter, the inverter will report the fault and stop.
10	Frequency setting up(UP)	This parameter is used to modify the increasing and decreasing command during the external terminal reference frequency.
11	Frequency setting down(DOWN)	
12	Frequency increasing/decreasing setting	

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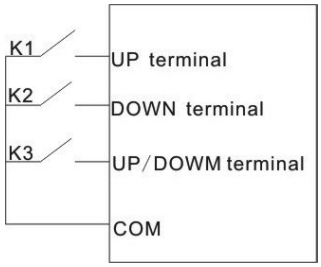
<table>
<tr><th>Set value</th><th>Function</th><th>Instructions</th></tr>
<tr><td></td><td>clear</td><td> 

Frequency increasing/decreasing setting clear terminal can cancel the assistant channel frequency set by the internal UP/DOWN of the inverter to make the reference frequency restore to the frequency reference by the main reference frequency channel.</td></tr>
<tr><td>13</td><td>Shifting between A setting and B setting</td><td rowspan="3">This function can realize the shifting between the frequency setting channels.
The 13th function can realize the shifting between A frequency reference channel and B frequency reference channel.
The 14th function can realize the shifting between A frequency reference channel and the combination setting channel set by P00.09
The 15th function can realize the shifting between B frequency reference channel and the combination setting channel set by P00.09</td></tr>
<tr><td>14</td><td>Shifting between A setting and combination setting</td></tr>
<tr><td>15</td><td>Shifting between B setting and combination setting</td></tr>
<tr><td>16</td><td>Multi-step speed terminal 1</td><td rowspan="4">The 16 step speeds can be set by the combination of digital state of four terminals.
Note: multi-step speed 1is the low position, multi-step speed 4 is the high position.
<table><tr><td>Multi-step speed 4</td><td>Multi-step speed 3</td><td>Multi-step speed 2</td><td>Multi-step speed 1</td></tr><tr><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr></table></td></tr>
<tr><td>17</td><td>Multi-step speed terminal 2</td></tr>
<tr><td>18</td><td>Multi-step speed terminal 3</td></tr>
<tr><td>19</td><td>Multi-step speed terminal 4</td></tr>
<tr><td>20</td><td>Multi-step speed pause</td><td>Shield the multi-step speed selection terminal function to keep the setting value at the current state.</td></tr>
<tr><td>21</td><td>ACC/DEC time selection 1</td><td>Select 4 ACC/DEC time by the combination of the 2</td></tr>
</table>

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<table>
<tr><th>Set value</th><th>Function</th><th>Instructions</th></tr>
<tr><td rowspan="6">22</td><td rowspan="6">ACC/DEC time selection 2</td><td colspan="4">terminals.</td></tr>
<tr><td>Terminal 1</td><td>Terminal 2</td><td>ACC/DEC time selection</td><td>Corresponding parameter</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td><td>P00.11/P00.12</td></tr>
<tr><td>ON</td><td>OFF</td><td>ACC/DEC time 2</td><td>P08.00/P08.01</td></tr>
<tr><td>OFF</td><td>ON</td><td>ACC/DEC time 3</td><td>P08.02/P08.03</td></tr>
<tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td><td>P08.04/P08.05</td></tr>
<tr><td>23</td><td>Simple PLC stop reset</td><td colspan="4">Restart simple PLC and clear the memory state of PLC.</td></tr>
<tr><td>24</td><td>Simple PLC pause</td><td colspan="4">Program pause during PLC implement. Run at the current speed step. After cancel the function, simple PLC continues to run.</td></tr>
<tr><td>25</td><td>PID control pause</td><td colspan="4">Temporal PID invalid and the inverter will output at the current frequency.</td></tr>
<tr><td>26</td><td>Traverse pause (stop at the current frequency)</td><td colspan="4">The inverter will stop at the current output and after canceling the function, the inverter will continue to traverse run at the current frequency.</td></tr>
<tr><td>27</td><td>Traverse reset (return to the middle frequency)</td><td colspan="4">The setting frequency of the inverter will come back to the middle frequency.</td></tr>
<tr><td>28</td><td>Counter reset</td><td colspan="4">Counter clear</td></tr>
<tr><td>29</td><td>Torque control prohibition</td><td colspan="4">Switch from torque control mode to speed control mode</td></tr>
<tr><td>30</td><td>ACC/DEC disabling</td><td colspan="4">Ensure the inverter will not be affected by the external signals (except for the stopping command) and keep the current output frequency.</td></tr>
<tr><td>31</td><td>Counter trigging</td><td colspan="4">Enable the pulse counter.</td></tr>
<tr><td>32</td><td>Length reset</td><td colspan="4">Length counter clear</td></tr>
<tr><td>33</td><td>Frequency increasing/decreasing setting temporal clear</td><td colspan="4">When the terminal closes, the frequency set by UP/DOWN can be cleared. All set frequency will be restored into the reference frequency by the frequency command channel and the frequency will</td></tr>
</table>

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Set value	Function	Instructions
		come back to the value after the frequency increasing or decreasing.
34	DC braking	The inverter will begin DC braking after the valid command.
35	Reserved	
36	Shift the command to the keypad	After the function terminal become valid, the running command channel will be shifted into keypad running command channel and the running command channel will come back to the original state if the function terminal is invalid.
37	Shift the command to the terminals	After the function terminal become valid, the running command channel will be shifted into terminal running command channel and the running command channel will come back to the original state if the function terminal is invalid.
38	Shift the command to the communication	After the function terminal become valid, the running command channel will be shifted into communication running command channel and the running command channel will come back to the original state if the function terminal is invalid.
39	Pre-exciting command	The function is started if the command is valid
40	Power consumption clear	The power consumption will be cleared after the command is valid.
41	Power consumption retention	If the command is valid, the current running of the inverter will not affect its power consumption.
42~60	Reversed	
61	PID pole switching	Switch the output pole of PID and be used with P09.03
62~63	Reversed	

Relative parameters list:

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Function code	Name	Detailed instruction of parameters	Default value
P05.00	HDI input type selection	0:HDI is high pulse input 1:HDI is switch input	0
P05.01	S1 terminal function selection	0: No function 1: Forward rotation operation (FWD) 2: Reverse rotation operation (REV) 3: 3-wire control operation (SIn) 4: Forward rotation jogging 5: Reverse rotation jogging 6: Coast to stop 7: Fault reset 8: Operation pause 9: External fault input 10:Increasing frequency setting(UP) 11:Decreasing frequency setting(DOWN) 12:Cancel the frequency change setting 13:Shift between A setting and B setting 14:Shift between combination setting and A setting 15:Shift between combination setting and B setting 16:Multi-step speed terminal 1 17:Multi-step speed terminal 2 18:Multi-step speed terminal 3 19:Multi- step speed terminal 4 20:Multi- step speed pause 21:ACC/DEC time option 1 22:ACC/DEC time option 2 23:Simple PLC stop reset 24:Simple PLC pause 25:PID control pause 26:Traverse Pause (stop at the current frequency)	1
P05.02	S2 terminal function selection		4
P05.03	S3 terminal function selection		7
P05.04	S4 terminal function selection		0
P05.05	S5 terminal function selection		0
P05.06	S6 terminal function selection		0
P05.07	S7 terminal function selection		0
P05.08	S8 terminal function selection		0
P05.09	HDI terminal function selection		0

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Function code	Name	Detailed instruction of parameters	Default value
		27:Traverse reset (return to the center frequency) 28:Counter reset 29: Torque control prohibition 30:ACC/DEC prohibition 31:Counter trigger 32:Length reset 33:Cancel the frequency change setting temporally 34:DC brake 35: Reserved 36:Shift the command to the keypad 37:Shift the command to the terminals 38:Shift the command to the communication 39: Pre-exciting command 40:Clear the power 41:Keep the power 42~60:Reserved 61: PID pole switching 42~63: Reserved	
P05.10	Polarity selection of the input terminals	0x000~0x1FF	0x000
P05.11	ON-OFF filter time	0.000~1.000s	0.010s
P05.12	Virtual terminals setting	0x000~0x1FF(0: Disabled, 1:Enabled) BIT0:S1 virtual terminal BIT1:S2 virtual terminal BIT2:S3 virtual terminal BIT3:S4 virtual terminal BIT4:S5 virtual terminal BIT5:S6 virtual terminal BIT6:S7 virtual terminal	0

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Function code	Name	Detailed instruction of parameters	Default value
		BIT7:S8 virtual terminal BIT8:HDI virtual terminal	
P05.13	Terminals control running mode	0:2-wire control 1 1:2-wire control 2 2:3-wire control 1 3:3-wire control 2	0
P05.14	S1 terminal switching-on delay time	0.000~50.000s	0.000s
P05.15	S1 terminal switching-off delay time	0.000~50.000s	0.000s
P05.16	S2 terminal switching-on delay time	0.000~50.000s	0.000s
P05.17	S2 terminal switching-off delay time	0.000~50.000s	0.000s
P05.18	S3 terminal switching-on delay time	0.000~50.000s	0.000s
P05.19	S3 terminal switching-off delay time	0.000~50.000s	0.000s
P05.20	S4 terminal switching-on delay time	0.000~50.000s	0.000s
P05.21	S4 terminal switching-off delay time	0.000~50.000s	0.000s
P05.22	S5 terminal switching-on delay time	0.000~50.000s	0.000s
P05.23	S5 terminal switching-off delay time	0.000~50.000s	0.000s

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Function code	Name	Detailed instruction of parameters	Default value
P05.24	S6 terminal switching-on delay time	0.000~50.000s	0.000s
P05.25	S6 terminal switching-off delay time	0.000~50.000s	0.000s
P05.26	S7 terminal switching-on delay time	0.000~50.000s	0.000s
P05.27	S7 terminal switching-off delay time	0.000~50.000s	0.000s
P05.28	S8 terminal switching-on delay time	0.000~50.000s	0.000s
P05.29	S8 terminal switching-off delay time	0.000~50.000s	0.000s
P05.30	HDI terminal switching-on delay time	0.000~50.000s	0.000s
P05.31	HDI terminal switching-off delay time	0.000~50.000s	0.000s
P07.39	Bus voltage at current fault		0
P17.12	ON-OFF input terminals state		0

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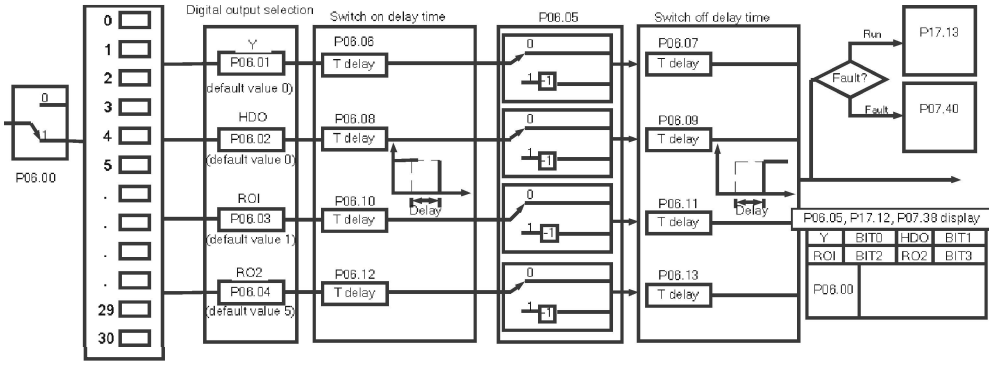
7.12 Digital output



Goodrive200 series inverters have 2 relay output terminals and 1 open-collector output terminal and 1 high speed pulse output terminal in the standard configuration. All functions of the digital input terminals are programmable by the function codes. Open collector pole output can be selected into high speed pulse input terminal or common switch input terminal by function code.

The below table is the option of the four function parameters and selecting the repeated output terminal function is allowed.

Set value	Function	Instructions
0	Invalid	The output terminal has no function.
1	Running	Output ON signal when the inverter is running and there is frequency output.
2	Forward running	Output ON signal when the inverter is running forward and there is frequency output.
3	Reverse running	Output ON signal when the inverter is running reverse and there is frequency output.
4	Jogging	Output ON signal when the inverter is jogging and there is frequency output.
5	Inverter fault	Output ON signal when the inverter is in fault
6	FDT1	Please refer to P08.32 and P08.33 for detailed information.
7	FDT2	Please refer to P08.34 and P08.35 for detailed information.
8	Frequency arrival	Please refer to P08.36 for detailed information.
9	Zero-speed running	Output ON signal when the output frequency and reference frequency of the inverter is 0 at the same

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Set value	Function	Instructions
		time.
10	Upper-limit frequency arrival	Output ON signal when the running frequency of the inverter is the upper limit frequency.
11	Lower-limit frequency arrival	Output ON signal when the running frequency of the inverter is the lower limit frequency.
12	Ready	When the main circuit and the control circuit are established and the protection function of the inverter is not active. The inverter is in the running state and it will output ON signal.
13	In pre-exciting	Output ON signal during pre-exciting
14	Overload pre-alarm	Output ON signal if the inverter is beyond the pre-alarm point. Refer to P11.08~P11.10 for the detailed instruction.
15	Underload pre-alarm	Output ON signal if the inverter is beyond the pre-alarm point. Refer to P11.11~P11.12 for the detailed instruction.
16	Simple PLC step completion	Output signal if the simple PLC step is completed.
17	Simple PLC cycle completion	Output signal if the 1 simple PLC cycle is completed.
18	Set counting arrival	Output ON signal if the detected counting exceeds the set value of P08.25.
19	Fixed counting arrival	Output ON signal if the detected counting exceeds the set value of P08.26.
20	External fault valid	Output ON signal if external fault occurs.
21	Length arrival	Output ON signal if the actual detected length exceeds the se length by P08.19.
22	Running time arrival	Output ON signal if the accumulative running time of the inverter exceeds the setting time by P08.27.
23	MODBUS communication virtual terminal output	Output corresponding signal according to the setting value of MODBUS. Output ON signal if the setting value is 1 and output OFF signal if the setting value is 0.
24~25	Reserved	

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Set value	Function	Instructions
26	DC bus voltage establishment	
27	Auxiliary motor 1 start	Please refer to the detailed instruction of P24.10, P24.11 and P24.12.
28	Auxiliary motor 2 start	
29~30	Reserved	

Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P06.00	HDO output	0:Open collector pole high speed pulse output 1: Open collector pole output	0
P06.01	Y1 output	0:Invalid 1:On operation 2:Forward rotation operation 3:Reverse rotation operation 4: Jogging operation 5:The inverter fault 6:FDT1 7:FDT2 8:Frequency arrival 9:Zero speed running 10:Upper limit frequency arrival 11:Lower limit frequency arrival 12:Ready for operation 13:Reserved 14:Ooverload pre-alarm 15: Uunderload pre-alarm 16:Ccompletion of simple PLC step 17:Completion of simple PLC cycle 18:Setting count value arrival 19:Defined count value arrival 20:External fault valid 21:Length arrival 22:Running time arrival 23:MODBUS communication virtual terminals output	0
P06.02	HDO output		0
P06.03	Relay RO1 output		1
P06.04	Relay RO2 output		5

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Function code	Name	Detailed instruction of parameters	Default value
		26: DC bus voltage establishment 27: Auxiliary motor 1 28: Auxiliary motor 2 24~25 and 29~30: Reserved	
P06.05	Polarity selection of output terminals	0x0~0xF	0x0
P06.06	Y1 switching-on delay time	0.000~50.000s	0.000s
P06.07	Y1 switching-off delay time	0.000~50.000s	0.000s
P06.08	HDO switching-on delay time	0.000~50.000s (valid only when P06.00=1)	0.000s
P06.09	HDO switching-off delay time	0.000~50.000s (valid only when P06.00=1)	0.000s
P06.10	RO1 switching-on delay time	0.000~50.000s	0.000s
P06.11	RO1 switching-off delay time	0.000~50.000s	0.000s
P06.12	RO2 switching-on delay time	0.000~50.000s	0.000s
P06.13	RO2 switching-off delay time	0.000~50.000s	0.000s
P07.40	The Max. temperature at current fault		0
P17.13	ON-OFF output terminals state		0

7.13 Simple PLC

Simple PLC function is also a multi-step speed generator. The inverter can change the running frequency, direction to meet the need of processing according to the running time automatically. In the past, this function needs to be assisted by external PLC, but now the inverter can realize this function by itself.

The series inverters can control 16-step speed with 4 groups of ACC/DEC time.

The multi-function digital output terminals or multi-function relay output an ON signal when the set

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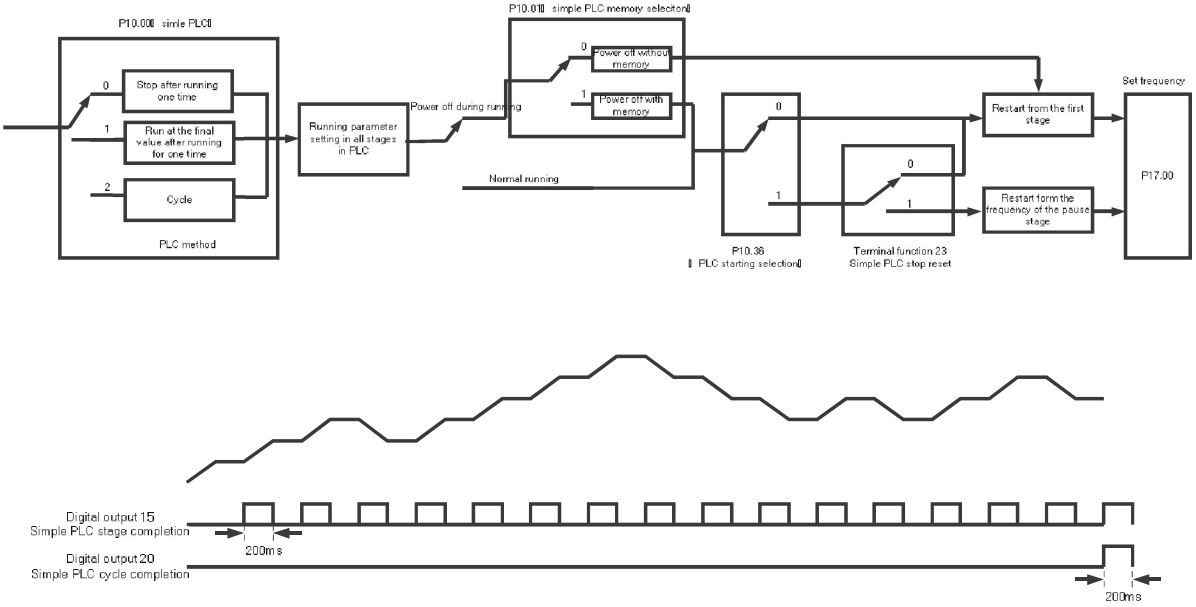
PLC finishes a circle (or a step).



Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P10.00	Simple PLC	0:Stop after running once 1:Run at the final value after running once 2:Cycle running	0
P10.01	Simple PLC memory	0:Power loss without memory 1:Power loss memory	0
P10.02	Multi-step speed 0	-100.0~100.0%	0.0%
P10.03	The running time of step 0	0.0~6553.5s(min)	0.0s
P10.04	Multi-step speed 1	-100.0~100.0%	0.0%
P10.05	The running time of step 1	0.0~6553.5s(min)	0.0s
P10.06	Multi-step speed 2	-100.0~100.0%	0.0%
P10.07	The running time of step 2	0.0~6553.5s（min）	0.0s
P10.08	Multi-step speed 3	-100.0~100.0%	0.0%
P10.09	The running time of step 3	0.0~6553.5s(min)	0.0s

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Function code	Name	Detailed instruction of parameters	Default value
P10.10	Multi-step speed 4	-100.0~100.0%	0.0%
P10.11	The running time of step 4	0.0~6553.5s(min)	0.0s
P10.12	Multi-step speed 5	-100.0~100.0%	0.0%
P10.13	The running time of step 5	0.0~6553.5s(min)	0.0s
P10.14	Multi-step speed 6	-100.0~100.0%	0.0%
P10.15	The running time of step 6	0.0~6553.5s(min)	0.0s
P10.16	Multi-step speed 7	-100.0~100.0%	0.0%
P10.17	The running time of step 7	0.0~6553.5s(min)	0.0s
P10.18	Multi-step speed 8	-100.0~100.0%	0.0%
P10.19	The running time of step 8	0.0~6553.5s(min)	0.0s
P10.20	Multi-step speed 9	-100.0~100.0%	0.0%
P10.21	The running time of step 9	0.0~6553.5s(min)	0.0s
P10.22	Multi-step speed 10	-100.0~100.0%	0.0%
P10.23	The running time of step 10	0.0~6553.5s(min)	0.0s
P10.24	Multi-step speed 11	-100.0~100.0%	0.0%
P10.25	The running time of step 11	0.0~6553.5s(min)	0.0s
P10.26	Multi-step speed 12	-100.0~100.0%	0.0%
P10.27	The running time of step 12	0.0~6553.5s(min)	0.0s
P10.28	Multi-step speed 13	-100.0~100.0%	0.0%
P10.29	The running time of step 13	0.0~6553.5s(min)	0.0s
P10.30	Multi-step speed 14	-100.0~100.0%	0.0%
P10.31	The running time of step 14	0.0~6553.5s(min)	0.0s
P10.32	Multi-step speed 15	-100.0~100.0%	0.0%
P10.33	The running time of step 15	0.0~6553.5s(min)	0.0s
P10.36	PLC restart	0:Restart from the first step 1:Continue to run from the stop frequency	0
P10.34	Simple PLC 0~7 step ACC/DEC time	0x0000~0XFFFF	0000
P10.35	Simple PLC 8~15 step ACC/DEC time selection	0x0000~0XFFFF	0000

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Function code	Name	Detailed instruction of parameters	Default value
P05.01~ P05.09	Digital input function selection	23:Simple PLC stop reset 24:Simple PLC pause	
P06.01~ P06.04	Digital output function selection	15: Underload pre-alarm 16:Completion of simple PLC step	
P17.00	Set frequency	0.00Hz~P00.03 (the Max. output frequency)	0.00Hz
P17.27	Simple PLC and the current step of the multi-step speed		

7.14 Multi-step speed running

Set the parameters when the inverter carries out multi-step speed running. Goodrive200 series inverters can set 16 step speed which can be selected by the combination code of multi-step speed terminals 1~4. They correspond to multi-step speed 0 to 15.

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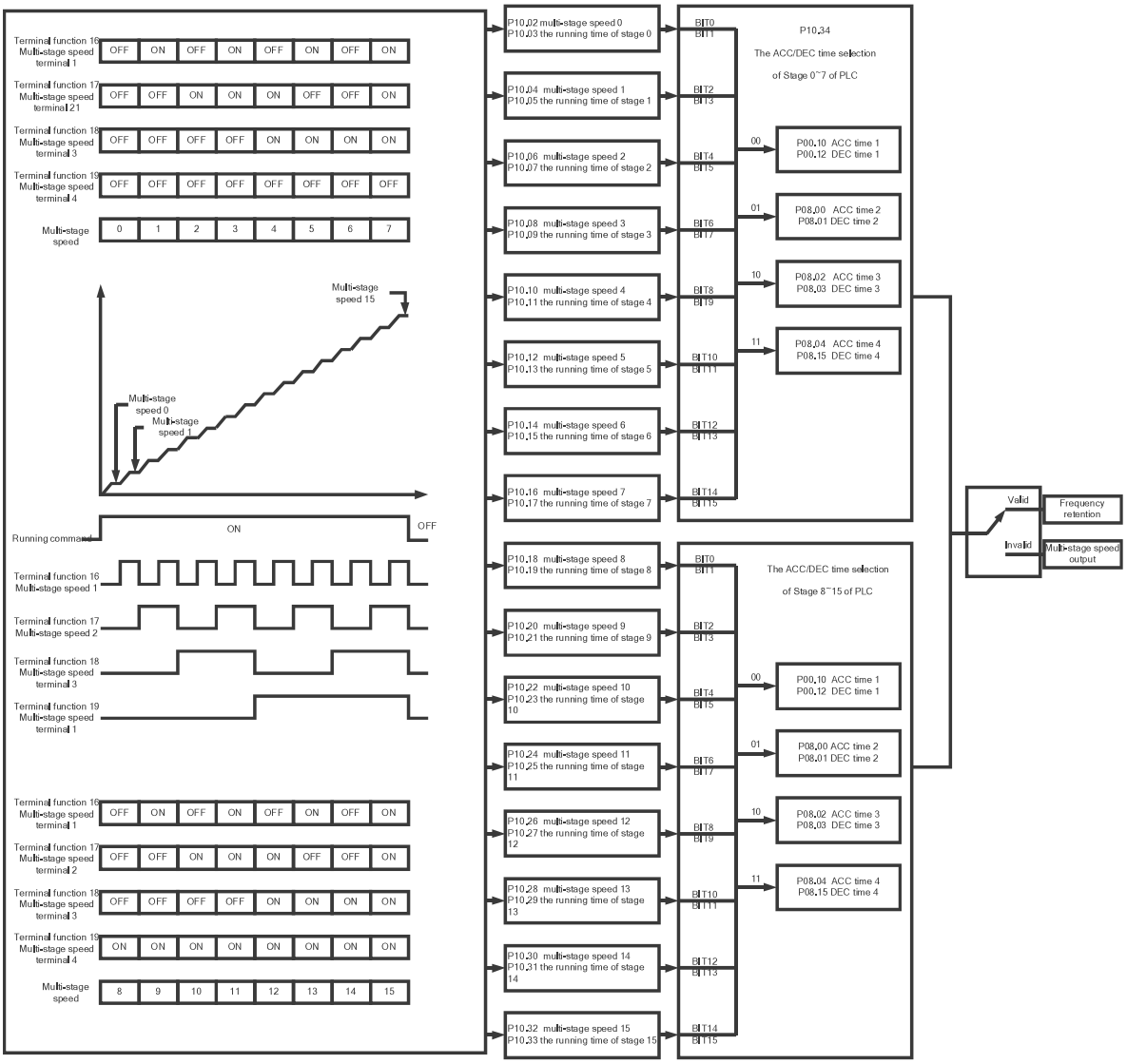

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Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P10.02	Multi-step speed 0	-100.0~100.0%	0.0%
P10.03	The running time of step 0	0.0~6553.5s(min)	0.0s
P10.04	Multi-step speed 1	-100.0~100.0%	0.0%
P10.05	The running time of step 1	0.0~6553.5s(min)	0.0s
P10.06	Multi-step speed 2	-100.0~100.0%	0.0%
P10.07	The running time of step 2	0.0~6553.5s(min)	0.0s
P10.08	Multi-step speed 3	-100.0~100.0%	0.0%
P10.09	The running time of step 3	0.0~6553.5s(min)	0.0s
P10.10	Multi-step speed 4	-100.0~100.0%	0.0%
P10.11	The running time of step 4	0.0~6553.5s（min）	0.0s
P10.12	Multi-step speed 5	-100.0~100.0%	0.0%
P10.13	The running time of step 5	0.0~6553.5s(min)	0.0s
P10.14	Multi-step speed 6	-100.0~100.0%	0.0%
P10.15	The running time of step 6	0.0~6553.5s(min)	0.0s
P10.16	Multi-step speed 7	-100.0~100.0%	0.0%
P10.17	The running time of step 7	0.0~6553.5s(min)	0.0s
P10.18	Multi-step speed 8	-100.0~100.0%	0.0%
P10.19	The running time of step 8	0.0~6553.5s(min)	0.0s
P10.20	Multi-step speed 9	-100.0~100.0%	0.0%
P10.21	The running time of step 9	0.0~6553.5s(min)	0.0s
P10.22	Multi-step speed 10	-100.0~100.0%	0.0%
P10.23	The running time of step 10	0.0~6553.5s(min)	0.0s
P10.24	Multi-step speed 11	-100.0~100.0%	0.0%
P10.25	The running time of step 11	0.0~6553.5s(min)	0.0s
P10.26	Multi-step speed 12	-100.0~100.0%	0.0%
P10.27	The running time of step 12	0.0~6553.5s(min)	0.0s
P10.28	Multi-step speed 13	-100.0~100.0%	0.0%
P10.29	The running time of step 13	0.0~6553.5s(min)	0.0s
P10.30	Multi-step speed 14	-100.0~100.0%	0.0%
P10.31	The running time of step 14	0.0~6553.5s(min)	0.0s

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Function code	Name	Detailed instruction of parameters	Default value
P10.32	Multi-step speed 15	-100.0~100.0%	0.0%
P10.33	The running time of step 15	0.0~6553.5s(min)	0.0s
P10.34	Simple PLC 0~7 step ACC/DEC time	0x0000~0XFFFF	0000
P10.35	Simple PLC 8~15 step ACC/DEC time	0x0000~0XFFFF	0000
P05.01~ P05.09	Digital input function selection	16:Multi-step speed terminal 1 17:Multi-step speed terminal 2 18:Multi-step speed terminal 3 19:Multi- step speed terminal 4 20:Multi- step speed pause	
P17.27	Simple PLC and the current step of the multi-step speed		

7.15 PID control

PID control is commonly used to control the procedure. Adjust the output frequency by proportional, integral, differential operation with the dispersion of the target signals to stabilize the value on the target. It is possible to apply to the flow, pressure and temperature control. Figure of basic control is as below:

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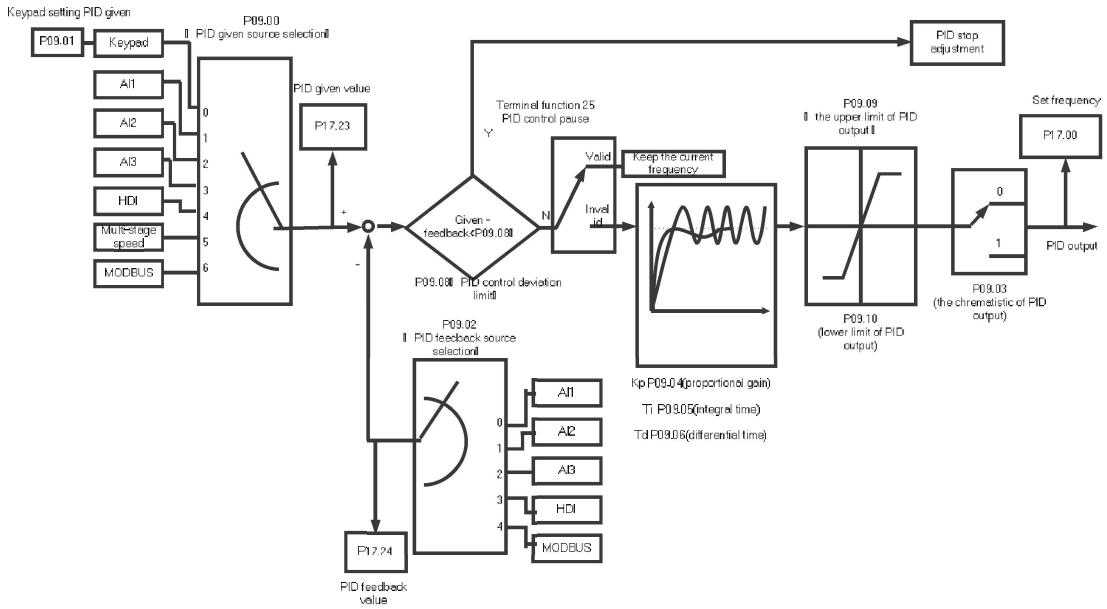

Simple illustration of the PID control operation and adjustment:

Proportional adjustment (Kp): when there is an error between the feedback and the reference, a proportional adjustment will be output. If the error is constant, the adjustment will be constant, too. Proportional adjustment can respond to the feedback change quickly, but it can not realize non-fault control. The gain will increase with the adjustment speed, but too much gain may cause vibration. The adjustment method is: set a long integration time and derivation time to 0 first. Secondly make the system run by proportional adjustment and change the reference. And then watch the error of the feedback signal and the reference. If the static error is available (for example, increasing the reference, the feedback will be less than the reference after a stable system), continue to increase the gain, vice versa. Repeat the action until the static error achieves a little value.

Integration time (Ti): the output adjustment will accumulate if there is an error between the feedback and the reference. The adjustment will keep on increasing until the error disappears. If the error is existent all the time, the integration adjustor can cancel the static error effectively. Vibration may occur as a result of unstable system caused by repeated over-adjustment if the integration adjustor is too strong. The features of this kind of vibration are: the fluctuating feedback signal (around the reference) and increasing traverse range will cause vibration. Adjust the integration time parameter from a big value to a little one to change the integration time and monitor the result until a stable system speed is available.

Derivation time (Td): when the error between the feedback and the reference, a proportional adjustment will be output. The adjustment only depends on the direction and value of the error change other than the error itself. The derivation adjustment controls the change of feedback signals

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according to the changing trend when it fluctuates. Because the derivation may enlarge the interference to the system, especially the frequent-changing interference, please use it carefully.

When P00.06, P00. 07=7 or P04.27=6, the running mode of the inverter is procedure PID control.

7.15.1 General steps of PID parameters setting:

a Ensure the gain P

When ensure the gain P, firstly cancel the PID integration and derivation (set Ti=0 and Td=0, see the PID parameter setting for detailed information) to make proportional adjustment is the only method to PID. Set the input as 60%~70% of the permitted Max. Value and increase gain P from 0 until the system vibration occurs, vice versa, and record the PID value and set it to 60%~70% of the current value. Then the gain P commission is finished.

b Ensure the integration time

After ensuring the gain P, set an original value of a bigger integration time and decrease it until the system vibration occurs, vice versa, until the system vibration disappear. Record the Ti and set the integration time to 150%~180% of the current value. Then integration time commission is finished.

c Ensure the derivation time

Generally, it is not necessary to set Td which is 0.

If it needs to be set, set it to 30% of the value without vibration via the same method with P and Ti.

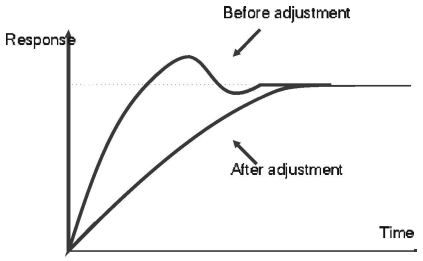
d Commission the system with and without load and then adjust the PID parameter until it is available.

7.15.2 PID inching

After setting the PID control parameters, inching is possible by following means:

Control the overshoot

Shorten the derivation time and prolong the integration time when overshoot occurs.



Achieve the stable state as soon as possible

Shorten the integration time (Ti) and prolong the derivation time (Td) even the overshoot occurs, but the control should be stable as soon as possible.

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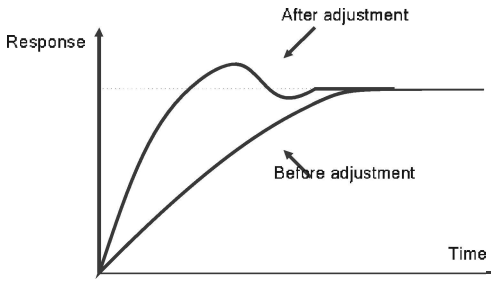
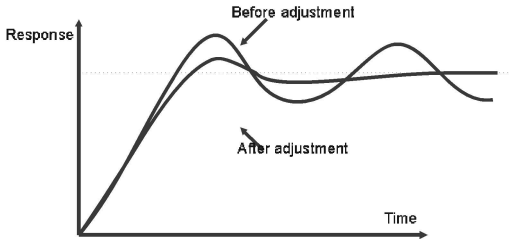


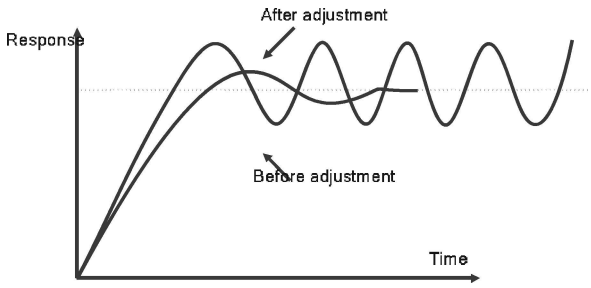
Control long vibration

If the vibration periods are longer than the set value of integration time (Ti), it is necessary to prolong the integration time (Ti) to control the vibration for the strong integration.



Control short vibration

Short vibration period and the same set value with the derivation time (Td) mean that the derivation time is strong. Shortening the derivation time (Td) can control the vibration. When setting the derivation time as 0.00(ire no derivation control) is useless to control the vibration, decrease the gain.



Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P09.00	PID reference source	0:Keypad digital reference(P09.01) 1:Analog channel AI1 reference 2:Analog channel AI2 reference 3:Analog channel AI3 set	0

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Function code	Name	Detailed instruction of parameters	Default value
		4:High speed pulse HDI set 5:Multi-step speed set 6:MODBUS communication 7~9:Reserved	
P09.01	Keypad PID preset	-100.0%~100.0%	0.0%
P09.02	PID feedback source	0:Analog channel AI1 feedback 1:Analog channel AI2 feedback 2:Analog channel AI3 feedback 3:High speed HDI feedback 4:MODBUS communication feedback 5~7:Reserved	0
P09.03	PID output feature	0:PID output is positive 1:PID output is negative	0
P09.04	Proportional gain (Kp)	0.00~100.00	1.00
P09.05	Integral time(Ti)	0.01~10.00s	0.10s
P09.06	Differential time(Td)	0.00~10.00s	0.00s
P09.07	Sampling cycle(T)	0.00~100.00s	0.10s
P09.08	PID control deviation limit	0.0~100.0%	0.0%
P09.09	Output upper limit of PID	P09.10~100.0% (Max. frequency or Max. voltage)	100.0%
P09.10	Output lower limit of PID	-100.0%~P09.09 (Max. frequency or Max. voltage)	0.0%
P09.11	Feedback offline detection value	0.0~100.0%	0.0%
P09.12	Feedback offline detection time	0.0~3600.0s	1.0s
P09.13	PID adjustment	LED ones: 0: Keep on integral adjustment when the frequency achieves the upper and low limit; the integration shows the change between the reference and the feedback	0x0001

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Function code	Name	Detailed instruction of parameters	Default value
		unless it reaches the internal integral limit. When the trend between the reference and the feedback changes, it needs more time to offset the impact of continuous working and the integration will change with the trend. 1: Stop integral adjustment when the frequency achieves the upper and low limit. If the integration keeps stable, and the trend between the reference and the feedback changes, the integration will change with the trend quickly. LED tens: P00.08 is 0 0: The same with the setting direction; if the output of PID adjustment is different from the current running direction, the internal will output 0 forcedly. 1:Opposite to the setting direction LED hundreds: P00.08 is 0 0: Limit to the maximum frequency 1: Limit to frequency A LED thousands: 0:A+B frequency, the buffer of A frequency is invalid 1:A+B frequency, the buffer of A frequency is valid ACC/DEC is determined by ACC time 4 of P08.04	
P17.00	Set frequency	0.00Hz~P00.03 (the Max. frequency)	0.00Hz
P17.23	PID reference value	-100.0~100.0%	0.0%
P17.24	PID feedback value	-100.0~100.0%	0.0%

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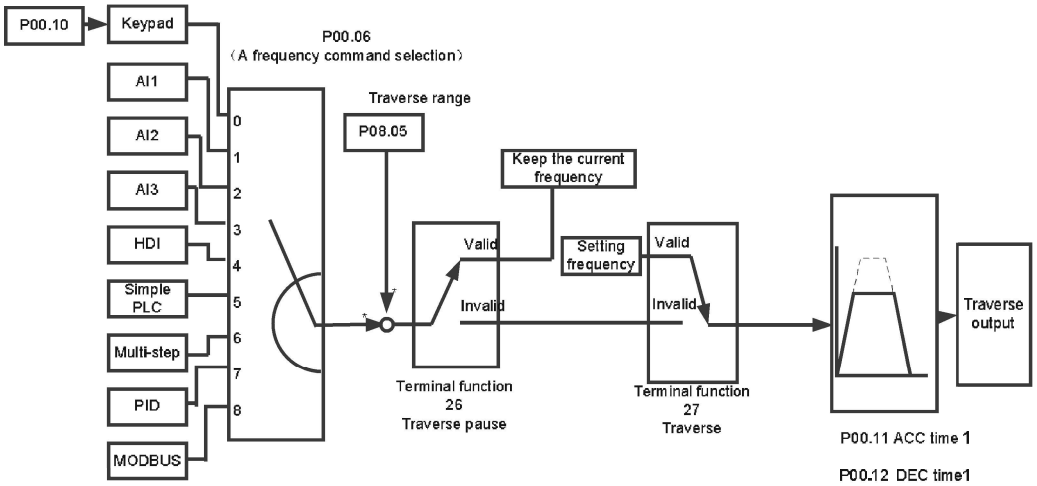
7.16 Traverse running

Traverse is applied in some industries such as textile, chemical fiber and cases where traverse and convolution is required. The working flowchart is as below:



Function code	Name	Detailed instruction of parameters	Default value
P00.03	Max. output frequency	P00.03~400.00Hz	50.00Hz
P00.06	A frequency command	0:Keypad data setting 1:Analog AI1 setting 2:Analog AI2 setting 3:Analog AI3 setting 4:High-speed pulse HDI setting 5:Simple PLC program setting 6:Multi-step speed running setting 7:PID control setting 8:MODBUS communication setting 9 ~11:Reserved	0
P00.11	ACC time 1	0.0~3600.0s	Depend on model
P00.12	DEC time 1	0.0~3600.0s	Depend on model

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Function code	Name	Detailed instruction of parameters	Default value
P05.01~P05.09	Digital input function selection	26:Traverse Pause (stop at the current frequency) 27:Traverse reset (return to the center frequency)	
P08.15	Traverse range	0.0~100.0% (relative to the setting frequency)	0.0%
P08.16	Sudden jumping frequency range	0.0~50.0% (relative to the traverse range)	0.0%
P08.17	Traverse boost time	0.1~3600.0s	5.0s
P08.18	Traverse declining time	0.1~3600.0s	5.0s

7.17 Pulse counter

Goodrive200 series inverters support pulse counter which can input counting pulse through HDI terminal. When the actual length is longer than or equal to the set length, the digital output terminal can output length arrival pulse signal and the corresponding length will be cleared automatically.

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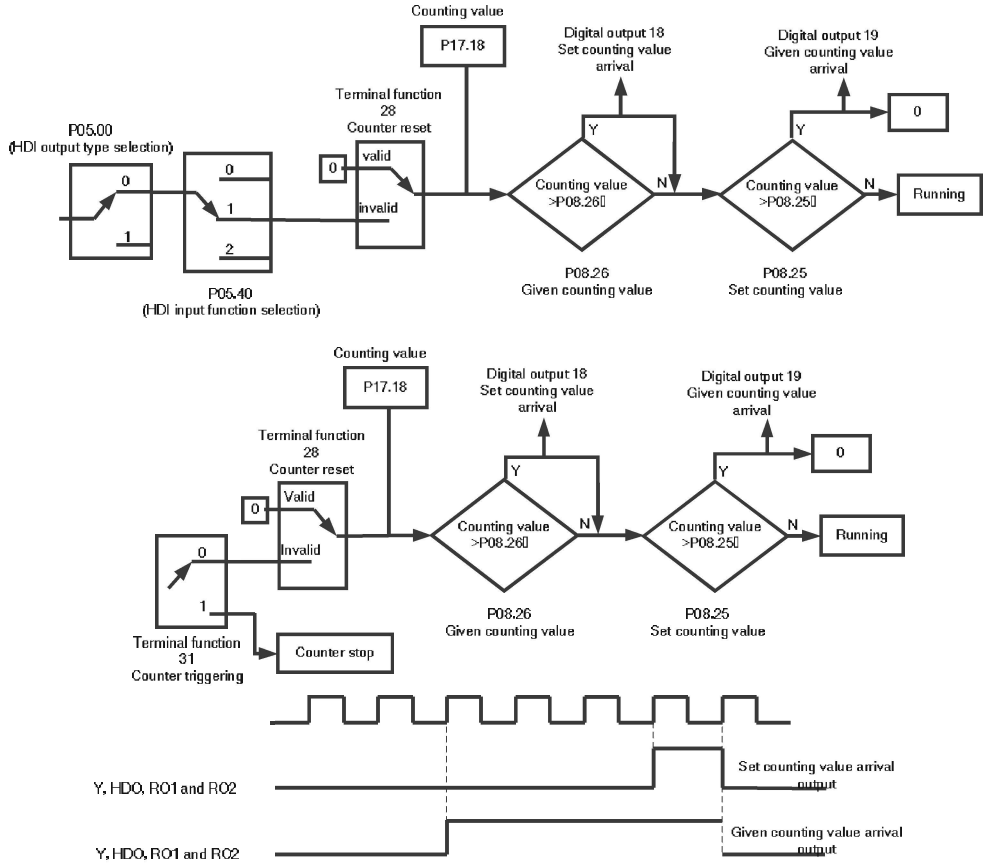

Function code	Name	Detailed instruction of parameters	Default value
P05.00	HDI input selection	0:HDI is high pulse input 1:HDI is switch input	0
P05.40	Corresponding setting of the upper limit of AI2	0:Frequency setting input 1:Counter input 2:Length counting input	0
P05.01~ P05.09	Digital input function selection	28:Counter reset 31:Counter trigger	
P06.01~ P06.04	Digital output function selection	17:Completion of simple PLC cycle 18:Setting count value arrival	
P08.25	Setting counting value	P08.26~65535	0
P08.26	Reference counting value	0~P08.25	0
P17.18	Counting value	0~65535	0

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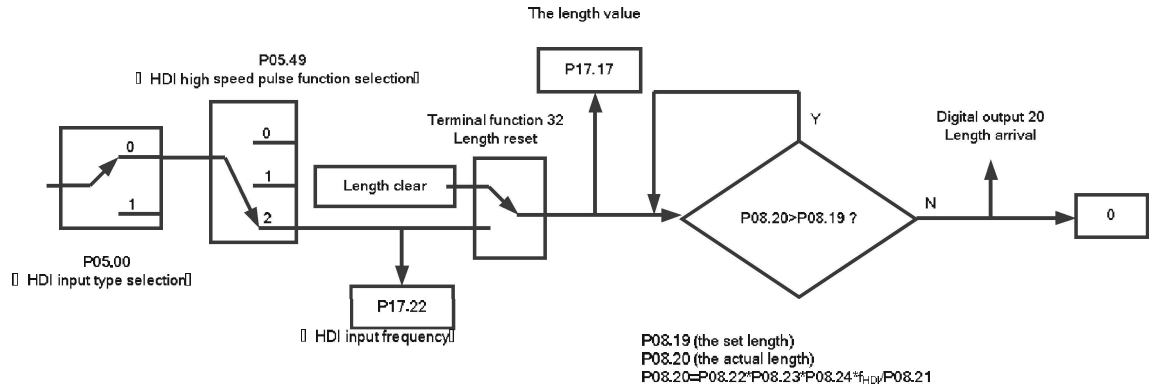
7.18 Fixed-length control

Goodrive200 series inverters support fixed-length control function which can input length counting pulse through HDI, and then count the actual length according to the internal counting formula. If the actual length is longer than or equal to the set length, the digital output terminal can output the length arrival pulse signal of 200ms and the corresponding length will be cleared automatically.



Note: the length arrival belongs to pulse output and the lasting time is 200ms.

Function code	Name	Detailed instruction of parameters	Default value
P05.00	HDI input type selection	0: HDI is high pulse input 1: HDI is switch input	0
P05.40	Corresponding setting of the upper limit of AI2	0: Frequency setting input 1: Counter input 2: Length counting input	0
P05.01~ P05.09	Digital input function selection	32: Length reset	
P06.01~ P06.04	Digital output function selection	21: Length arrival	
P08.19	Setting length	0~65535m	0
P08.20	Actual length	0~65535m	0
P08.21	Pulse per rotation	1~10000	1
P08.22	Alxe perimeter	0.01~100.00cm	10.00cm
P08.23	Length ratio	0.001~10.000	1.000

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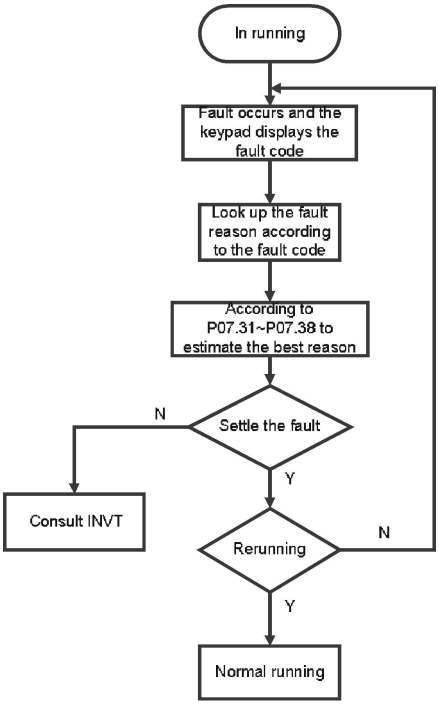
Function code	Name	Detailed instruction of parameters	Default value
P08.24	Length correcting coefficient	0.001~1.000	1.000
P17.17	Length	0~65535	0

7.19 Fault procedure

Goodrive200 series inverters provide sufficient fault procedure information for the convenience of user's application.



Relative parameters list:

Function code	Name	Detailed instruction of parameters	Default value
P07.27	Current fault type	0:No fault 1:IGBT U phase protection(OUt1) 2:IGBT V phase protection(OUt2) 3:IGBT W phase protection(OUt3) 4:OC1 5:OC2 6:OC3	0

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Function code	Name	Detailed instruction of parameters	Default value
		7:OV1 8:OV2 9:OV3 10:UV 11:Motor overload(OL1) 12:The inverter overload(OL2) 13:Input side phase loss(SPI) 14:Output side phase loss(SPO) 15:Overheating of the rectifier module(OH1) 16:Overheating fault of the inverter module(OH2) 17:External fault(EF) 18:485 communication fault(CE) 19:Current detection fault(ItE) 20:Motor antotune fault(tE) 21:EEPROM operation fault(EEP) 22:PID response offline fault(PIDE) 23:Braking unit fault(bCE) 24:Running time arrival(END) 25:Electrical overload(OL3) 26:Panel communication fault(PCE) 27:Parameter uploading fault (UPE) 28:Parameter downloading fault(DNE) 29~31:Reserved 32:Grounding short circuit fault 1(ETH1) 33: Grounding short circuit fault 2(ETH2) 34~35:Reserved 36:Underload fault (LL)	
P07.28	Previous fault type		
P07.29	Previous 2 fault type		
P07.30	Previous 3 fault type		

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Function code	Name	Detailed instruction of parameters	Default value
P07.31	Previous 4 fault type		
P07.32	Previous 5 fault type		
P07.33	Running frequency at current fault		0.00Hz
P07.34	Ramp reference frequency at current fault		0.00Hz
P07.35	Output voltage at the current fault		0V
P07.36	Output current at current fault		0.0A
P07.37	Bus voltage at current fault		0.0V
P07.38	The Max. temperature at current fault		0.0℃
P07.39	Input terminals state at current fault		0
P07.40	Output terminals state at current fault		0
P07.41	Running frequency at previous fault		0.00Hz
P07.42	Ramp reference frequency at previous fault		0.00Hz
P07.43	Output voltage at previous fault		0V
P07.44	The output current at previous fault		0.0A
P07.45	Bus voltage at previous fault		0.0V
P07.46	The Max. temperature at previous fault		0.0℃
P07.47	Input terminals state at		0

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Function code	Name	Detailed instruction of parameters	Default value
	previous fault		
P07.48	Output terminals state at previous fault		0
P07.49	Running frequency at previous 2 fault		0.00Hz
P07.50	Output voltage at previous 2 faults		0.00Hz
P07.51	Output current at previous 2 faults		0V
P07.52	Output current at previous 2 fault		0.0A
P07.53	Bus voltage at previous 2 fault		0.0V
P07.54	The Max. temperature at previous 2 fault		0.0℃
P07.55	Input terminals state at previous 2 fault		0
P07.56	Output terminals state at previous 2 fault		0

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Fault Tracking 8

8.1 What this chapter contains

This chapter describes how to reset faults and view fault history. It also lists all alarm and fault messages including the possible cause and corrective actions.

	✧**Only qualified electricians are allowed to maintain the inverter. Read the safety instructions in chapter Safety precautions before working on the inverter.**

8.2 Alarm and fault indications

Fault is indicated by LEDs. See ***Operation Procedure***. When TRIP light is on, an alarm or fault message on the panel display indicates abnormal inverter state. Using the information reference in this chapter, most alarm and fault cause can be identified and corrected. If not, contact with the INVT office.

8.3 How to reset

The inverter can be reset by pressing the keypad key STOP/RST, through digital input, or by switching the power light. When the fault has been removed, the motor can be restarted.

8.4 Fault history

Function codes P07.27~P07.32 store 6 recent faults. Function codes P07.33~P07.40, P07.41~P7.48 and P07.49~P07.56 show drive operation data when the latest 3 faults occurs.

8.5 Fault instruction and solution

Do as the following after the inverter fault:

1. Check to ensure there is nothing wrong with the keypad. If not, please contact with the local INVT office.

2. If there is nothing wrong, please check P07 and ensure the corresponding recorded fault parameters to confirm the real state when the current fault occurs by all parameters.

3. See the following table for detailed solution and check the corresponding abnormal state.

4. Eliminate the fault and ask for relative help.

5. Check to eliminate the fault and carry out fault reset to run the inverter.

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Fault code	Fault type	Possible cause	What to do
OUt1	IGBT Ph-U fault	●The acceleration is too fast ●IGBT module fault ●Misaction caused by interference ●The connection of the driving wires is not good, ●Grounding is not properly	●Increase Acc time ●Change the power unit ●Check the driving wires ●Inspect external equipment and eliminate interference
OUt2	IGBT Ph-V fault		
OUt3	IGBT Ph-W fault		
OC1	Over-current when acceleration	●The acceleration or deceleration is too fast ●The voltage of the grid is too low ●The power of the inverter is too low ●The load transients or is abnormal ●The grounding is short circuited or the output is phase loss ●There is strong external interference ●The overvoltage stall protection is not open	●Increase the ACC time ●Check the input power ●Select the inverter with a larger power ●Check if the load is short circuited (the grounding short circuited or the wire short circuited) or the rotation is not smooth ●Check the output configuration. ●Check if there is strong interference ●Check the setting of relative function codes
OC2	Over-current when deceleration		
OC3	Over-current when constant speed running		
OV1	Over-voltage when acceleration	●The input voltage is abnormal ●There is large energy feedback ●No braking components ●Braking energy is not open	●Check the input power ●Check if the DEC time of the load is too short or the inverter starts during the rotation of the motor or it needs to add the dynamic braking components ●Install the braking components ●Check the setting of relative function codes
OV2	Over-voltage when deceleration		
OV3	Over-voltage when constant speed running		
UV	DC bus Under-voltage	●The voltage of the power supply is too low ●The overvoltage stall protection is not open	●Check the input power of the supply line ●Check the setting of relative function codes

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Fault code	Fault type	Possible cause	What to do
OL1	Motor overload	●The voltage of the power supply is too low ●The motor setting rated current is incorrect ●The motor stall or load transients is too strong	●Check the power of the supply line ●Reset the rated current of the motor ●Check the load and adjust the torque lift
OL2	Inverter overload	●The acceleration is too fast ●Reset the rotating motor ●The voltage of the power supply is too low ●The load is too heavy ●The motor power is too small	●Increase the ACC time ●Avoid the restarting after stopping ●Check the power of the supply line ●Select an inverter with bigger power ●Select a proper motor
OL3	Electrical overload	●The inverter will report overload pre-alarm according to the set value	●Check the load and the overload pre-alarm point.
SPI	Input phase loss	●Phase loss or fluctuation of input R,S,T	●Check input power ●Check installation distribution
SPO	Output phase loss	●U,V,W phase loss input(or serious asymmetrical three phase of the load)	●Check the output distribution ●Check the motor and cable
OH1	Rectify overheat	●Air duct jam or fan damage ●Ambient temperature is too high ●The time of overload running is too long	●Clean the air duct or the fan ●Reduce the ambient temperature
OH2	IGBT overheat		
EF	External fault	●SI external fault input terminals action	●Check the external device input

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Fault code	Fault type	Possible cause	What to do
CE	Communication error	●The baud rate setting is incorrect ●Fault occurs to the communication wiring. ●The communication address is wrong ●There is strong interference to the communication	●Set proper baud rate ●Check the communication connection distribution ●Set proper communication address ●Chang or replace the connection distribution or improve the anti-interference capability
ItE	Current detection fault	●The connection of the control board is not good ●Hoare components is broken ●The modifying circuit is abnormal	●Check the connector and repatch ●Change the hoare ●Change the main control panel
tE	Autotuning fault	●The motor capacity does not comply with the inverter capability ●The rated parameter of the motor does not set correctly. ●The offset between the parameters autotunting and the standard parameter is huge ●Autotune overtime	●Change the inverter mode ●Set the rated parameter according to the motor name plate ●Empty the motor load and reindentify ●Check the motor connection and set the parameter. ●Check if the upper limit frequency is above 2/3 of the rated frequency.
EEP	EEPROM fault	●Error of controlling the write and read of the parameters ●Damage to EEPROM	●Press STOP/RST to reset ●Change the main control panel

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Fault code	Fault type	Possible cause	What to do
PIDE	PID feedback fault	●PID feedback offline ●PID feedback source disappear	●Check the PID feedback signal ●Check the PID feedback source
bCE	Braking unit fault	●Braking circuit fault or damage to the braking pipes ●The external braking resistor is not sufficient	●Check the braking unit and change new braking pipe ●Increase the braking resistor
ETH1	Grounding shortcut fault 1	●The output of the inverter is short circuited with the ground ●There is fault in the current detection circuit ●The actual motor power sharply differs from the inverter power	●Check if the connection of the motor is normal or not ●Change the hoare ●Change the main control panel ●Set motor parameters correctly
ETH2	Grounding shortcut fault 2	●The output of the inverter is short circuited with the ground ●There is fault in the current detection circuit ●The actual motor power sharply differs from the inverter power	●Check if the connection of the motor is normal or not ●Change the hoare ●Change the main control panel ●Set motor parameters correctly
dEu	Velocity deviation fault	●The load is too heavy or stalled	●Check the load and ensure it is normal ●Increase the detection time ●Check whether the control parameters are normal

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Fault code	Fault type	Possible cause	What to do
STo	Maladjustment fault	●The control parameters of the synchronous motors not set properly ●The autoturn parameter is not right ●The inverter is not connected to the motor	●Check the load and ensure it is normal ●Check whether the control parameter is set properly or not ●Increase the maladjustment detection time
END	Time reach of factory setting	●The actual running time of the inverter is above the internal setting running time	●Ask for the supplier and adjust the setting running time
PCE	Keypad communication fault	●The connection of the keypad wires is not good or broken ●The keypad wire is too long and affected by strong interference ●There is circuit fault on the communication of the keypad and main board	●Check the keypad wires and ensure whether there is mistake ●Check the environment and avoid the interference source ●Change the hardware and ask for service
DNE	Parameters downloading fault	●The connection of the keypad wires is not good or broken ●The keypad wire is too long and affected by strong interference ● There is mistake on the data storage of the keypad	●Check the keypad wires and ensure whether there is mistake ●Change the hardware and ask for service ●Repack-up the data in the keypad
LL	Electronic underload fault	●The inverter will report the underload pre-alarm according to the set value	●Check the load and the underload pre-alarm point

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8.5.2 Other states

Fault code	Fault type	Possible cause	What to do
PoFF	System power off	System power off or the bus voltage is too low	Check the grid
	Communication failure between the keypad and main control board	The keypad is not conneted correctly	Check the installation environment

8.6 Common fault analysis

8.6.1 The motor does not work

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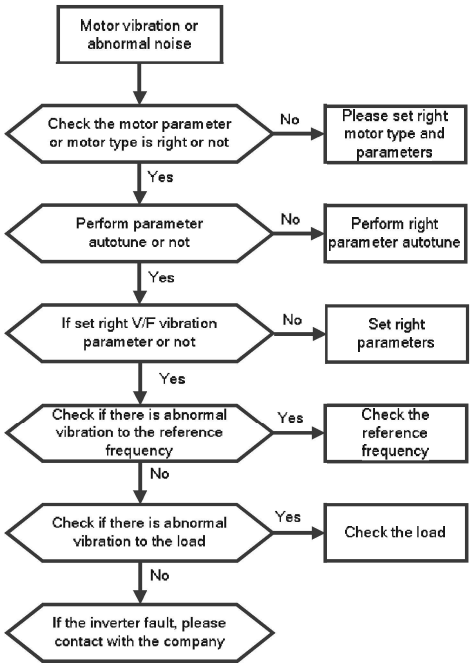
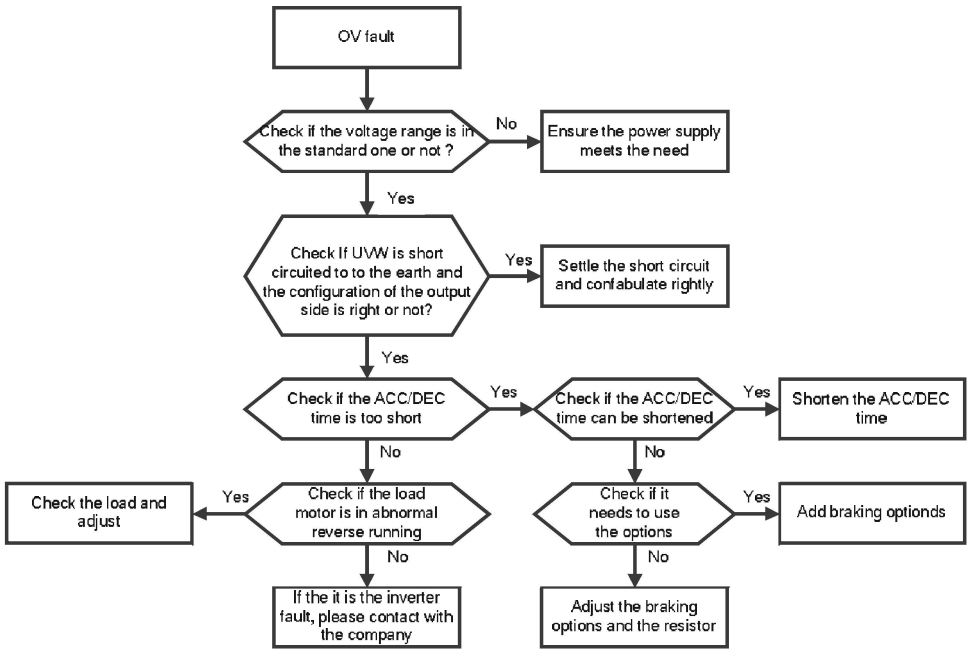
8.6.2 Motor vibration



8.6.3 Overvoltage



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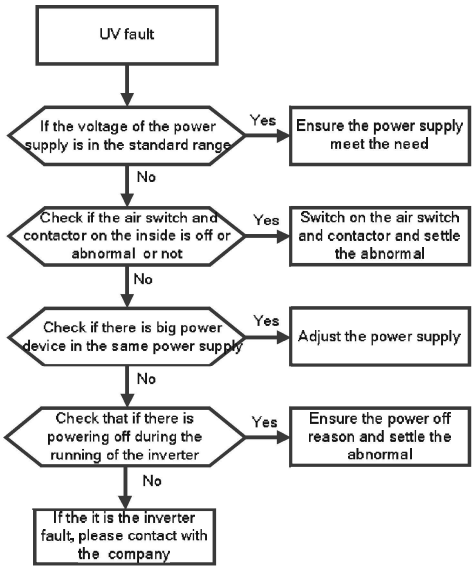
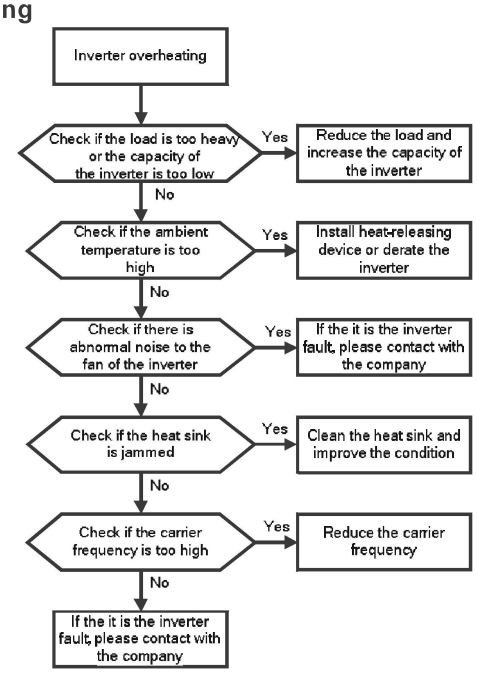
8.6.4 Undervoltage fault



8.6.5 Inverter overheating



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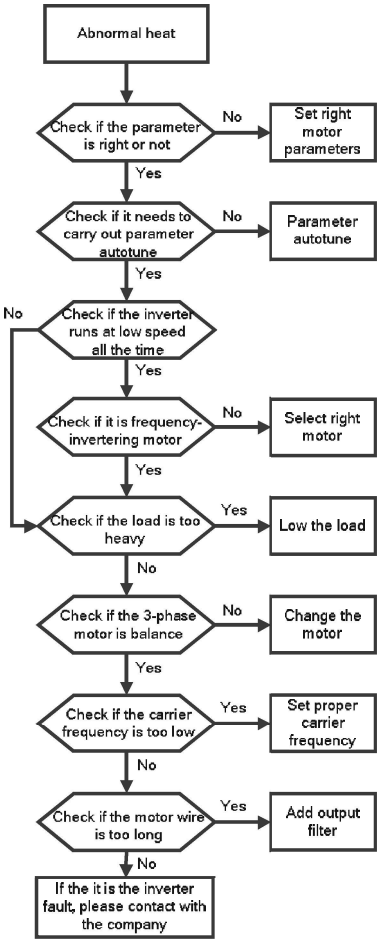
8.6.6 Abnormal motor heat



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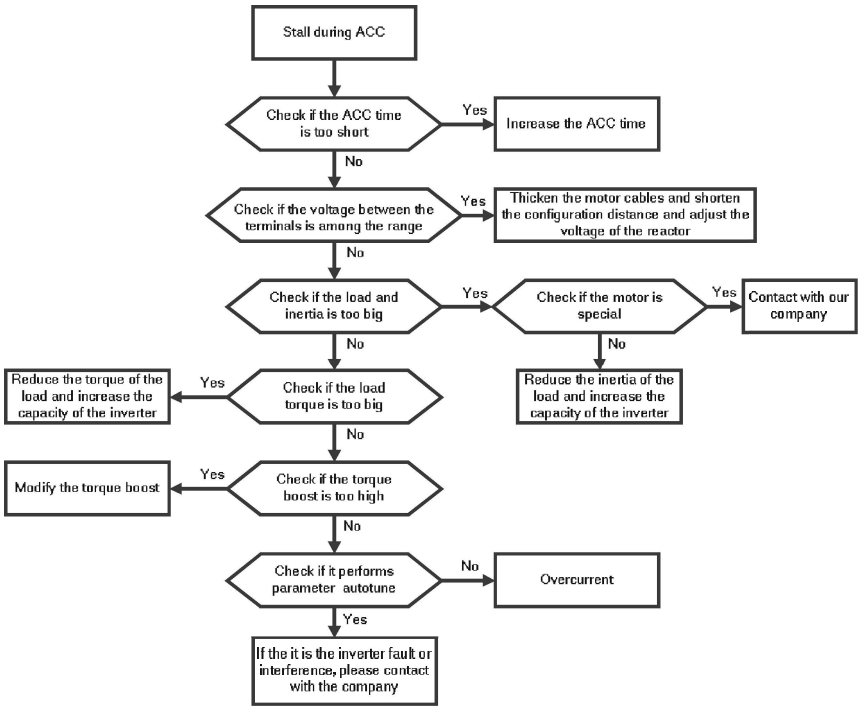
8.6.7 Stall during the acceleration of the motor



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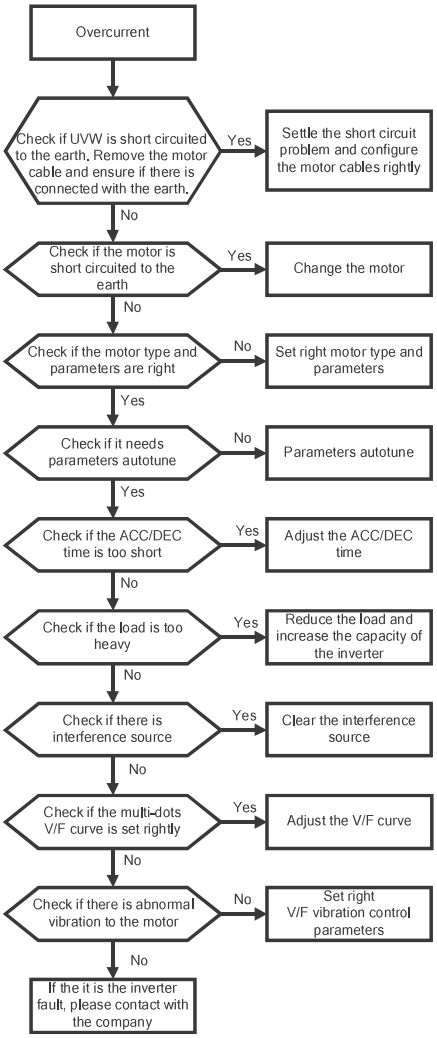
8.6.8 Overcurrent



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Maintenance and Hardware Diagnostics 9

9.1 What this chapter contains.

The chapter contains preventive maintenance instructions of the inverter.

9.2 Maintenance intervals

If installed in an appropriate environment, the inverter requires very little maintenance. The table lists the routine maintenance intervals recommended by INVT.

Checking part		Checking item	Checking method	Criterion
Ambient environment		Check the ambient temperature, humidity and vibration and ensure there is no dust, gas, oil fog and water drop.	Visual examination and instrument test	Conforming to the manual
		Ensure there are no tools or other foreign or dangerous objects	Visual examination	There are no tools or dangerous objects.
Voltage		Ensure the main circuit and control circuit are normal.	Measurement by millimeter	Conforming to the manual
Keypad		Ensure the display is clear enough	Visual examination	The characters are displayed normally.
		Ensure the characters are displayed totally	Visual examination	Conforming to the manual
Main circuit	For public use	Ensure the screws are tightened up	Tighten up	NA
		Ensure there is no distortion, crackles, damage or color-changing caused by overheating and aging to	Visual examination	NA

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Checking part		Checking item	Checking method	Criterion
		the machine and insulator.		
		Ensure there is no dust and dirtiness	Visual examination	NA **Note:** if the color of the copper blocks change, it does not mean that there is something wrong with the features.
	The lead of the conductors	Ensure that there is no distortion or color-changing of the conductors caused by overheating.	Visual examination	NA
		Ensure that there are no crackles or color-changing of the protective layers.	Visual examination	NA
	Terminals seat	Ensure that there is no damage	Visual examination	NA
	Filter capacitors	Ensure that there is no weeping, color-changing, crackles and cassis expansion.	Visual examination	NA
		Ensure the safety valve is in the right place.	Estimate the usage time according to the maintenance or measure the	NA

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Checking part		Checking item	Checking method	Criterion
			static capacity.	
		If necessary, measure the static capacity.	Measure the capacity by instruments.	The static capacity is above or equal to the original value *0.85.
	Resistors	Ensure whether there is replacement and splitting caused by overheating.	Smelling and visual examination	NA
		Ensure that there is no offline.	Visual examination or remove one ending to coagulate or measure with multimeters	The resistors are in ±10% of the standard value.
	Transformers and reactors	Ensure there is no abnormal vibration, noise and smelling,	Hearing, smelling and visual examination	NA
	Electromagnetism contactors and relays	Ensure whether there is vibration noise in the workrooms.	Hearing	NA
		Ensure the contactor is good enough.	Visual examination	NA
Control circuit	PCB and plugs	Ensure there are no loose screws and contactors.	Fasten up	NA
		Ensure there is no smelling and color-changing.	Smelling and visual examination	NA

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Checking part		Checking item	Checking method	Criterion
		Ensure there are no crackles, damage distortion and rust.	Visual examination	NA
		Ensure there is no weeping and distortion to the capacitors.	Visual examination or estimate the usage time according to the maintenance information	NA
Cooling system	Cooling fan	Estimate whether there is abnormal noise and vibration.	Hearing and Visual examination or rotate with hand	Stable rotation
		Estimate there is no losses screw.	Tighten up	NA
		Ensure there is no color-changing caused by overheating.	Visual examination or estimate the usage time according to the maintenance information	NA
	Ventilating duct	Ensure whether there is stuff or foreign objection in the cooling fan, air vent.	Visual examination	NA

Consult the local service representative for more details on the maintenance. Visit the official website of INVT: http://www.invt.com.cn and select Inverter Services – Maintenance and Services.

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9.3 Cooling fan

The inverter's cooling fan has a minimum life span of 25,000 operating hours. The actual life span depends on the inverter usage and ambient temperature.

The operating hours can be found through P07.14 (accumulative hours of the inverter).

Fan failure can be predicted by the increasing noise from the fan bearings. If the inverter is operated in a critical part of a process, fan replacement is recommended once these symptoms appear. Replacement fans are available from INVT.

Replacing the cooling fan

	✧**Read and follow the instructions in chapter *Safety Precautions*. Ignoring the instructions would cause physical injury or death, or damage to the equipment.**

1. Stop the inverter and disconnect it from the AC power source and wait for at least the time designated on the inverter.

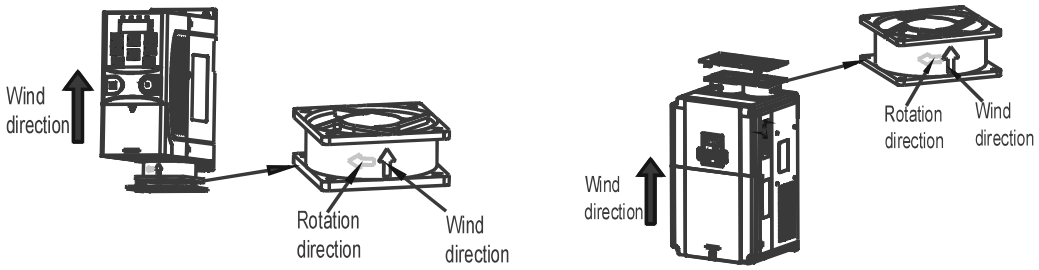
2. Lever the fan holder off the drive frame with a screwdriver and lift the hinged fan holder slightly upward from its front edge.

3. Loose the fan cable from the clip.

4. Disconnect the fan cable.

5. Remove the fan holder from the hinges.

6. Install the new fan holder including the fan in reverse order. Keep the wind direction of the fan consistent with that of the inverter, as shown below:



Fan maintenance diagram for inverters

7. Restore power.

9.4 Capacitors

9.4.1 Reforming the capacitors

The DC bus capacitors must be reformed according to the operation instruction if the inverter has been stored for a long time. The storing time is counted form the producing date

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other than the delivery data which has been marked in the serial number of the inverter.

Time	Operational principle
Storing time less than 1 year	Operation without charging
Storing time 1-2 years	Connect with the power for 1 hour before first ON command
Storing time 2-3 years	Use power surge to charge for the inverter • Add 25% rated voltage for 30 minutes • Add 50% rated voltage for 30 minutes • Add 75% rated voltage for 30 minutes • Add 100% rated voltage for 30 minutes
Storing time more than 3 years	Use power surge to charge for the inverter • Add 25% rated voltage for 2 hours • Add 50% rated voltage for 2 hours • Add 75% rated voltage for 2 hours • Add 100% rated voltage for 2 hours

The method of using power surge to charge for the inverter:

The right selection of Power surge depends on the supply power of the inverter. Single phase 220V AC/2A power surge applied to the inverter with single/three-phase 220V AC as its input voltage. The inverter with single/three-phase 220V AC as its input voltage can apply Single phase 220V AC/2A power surge. All DC bus capacitors charge at the same time because there is one rectifier.

High-voltage inverter needs enough voltage (for example, 380V) during charging. The small capacitor power (2A is enough) can be used because the capacitor nearly does not need current when charging.

The operation method of inverter charging through resistors (LEDs):

The charging time is at least 60 minutes if charge the DC bus capacitor directly through supply power. This operation is available on normal temperature and no-load condition and the resistor should be serially connected in the 3-phase circuits of the power supply:

380V drive device: 1k/100W resistor. LED of 100W can be used when the power voltage is no more than 380V. But if used, the light may be off or weak during charging.

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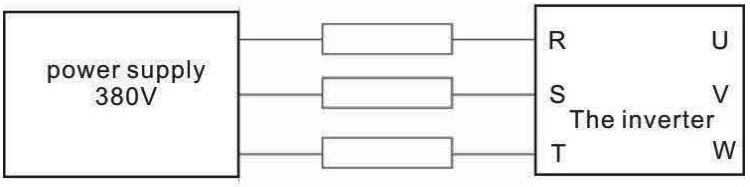

380V charging illustration of the driven device

9.4.2 Change electrolytic capacitors

⚠	✧**Read and follow the instructions in chapter *Safety Precautions*. Ignoring the instructions may cause physical injury or death, or damage to the equipment.**

Change electrolytic capacitors if the working hours of electrolytic capacitors in the inverter are above 35000. Please contact with the local INVT offices or dial our national service hotline (400-700-9997) for detailed operation.

9.5 Power cable

⚠	✧**Read and follow the instructions in chapter *Safety Precautions*. Ignoring the instructions may cause physical injury or death, or damage to the equipment.**

1. Stop the drive and disconnect it from the power line. Wait for at least the time designated on the inverter.
2. Check the tightness of the power cable connections.
3. Restore power.

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Communication Protocol 10

10.1 What this chapter contains

This chapter describes the communication protocol of Goodrive200 series inverters.

The Goodrive200 series inverters provide RS485 communication interface. It adopts international standard MODBUS communication protocol to perform master-slave communication. The user can realize centralized control through PC/PLC, upper control PC, etc. (set the control command, running frequency of the inverter, modify relevant function codes, monitor and control the operating state and fault information of the inverter and so on) to adapt specific application requirements.

10.2 Brief instruction to MODBUS protocol

MODBUS protocol is a software protocol and common language which is applied in the electrical controller. With this protocol, the controller can communicate with other devices via network (the channel of signal transmission or the physical layer, such as RS485). And with this industrial standard, the controlling devices of different manufacturers can be connected to an industrial network for the convenient of being monitored.

There are two transmission modes for MODBUS protocol: ASCII mode and RTU (Remote Terminal Units) mode. On one MODBUS network, all devices should select same transmission mode and their basic parameters, such as baud rate, digital bit, check bit, and stopping bit should have no difference.

MODBUS network is a controlling network with single-master and multiple slaves, which means that there is only one device performs as the master and the others are the slaves on one MODBUS network. The master means the device which has active talking right to sent message to MODBUS network for the controlling and inquiring to other devices. The slave means the passive device which sends data message to the MODBUS network only after receiving the controlling or inquiring message (command) form the master (response). After the master sends message, there is a period of time left for the controlled or inquired slaves to response, which ensure there is only one slave sends message to the master at a time for the avoidance of singles impact.

Generally, the user can set PC, PLC, IPC and HMI as the masters to realize central control. Setting certain device as the master is a promise other than setting by a bottom or a switch or the device has a special message format. For example, when the upper monitor is running, if the operator clicks sending command bottom, the upper monitor can send

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command message actively even it can not receive the message form other devices. In this case, the upper monitor is the master. And if the designer makes the inverter send the data only after receiving the command, then the inverter is the slave.

The master can communicate with any single slave or with all slaves. For the single-visiting command, the slave should feedback a response message; for the broadcasting message from the master, the slave does not need to feedback the response message.

10.3 Application of the inverter

The MODBUS protocol of the inverter is RTU mode and the physical layer is 2-wire RS485.

10.3.1 RS485

The interface of 2-wire RS485 works on semiduplex and its data signal applies differential transmission which is called balance transmission, too. It uses twisted pairs, one of which is defined as A (+) and the other is defined as B (-). Generally, if the positive electrical level between sending drive A and B is among +2~+6V, it is logic"1", if the electrical level is among -2V~-6V; it is logic"0".

485+ on the terminal board corresponds to A and 485- to B.

Communication baud rate means the binary bit number in one second. The unit is bit/s (bps). The higher the baud rate is, the quicker the transmission speed is and the weaker the anti-interference is. If the twisted pairs of 0.56mm（24AWG）is applied as the communication cables, the Max. Transmission distance is as below:

Baud rate	Max. transmission distance	Baud rate	Max. transmission distance
2400BPS	1800m	9600BPS	800m
4800BPS	1200m	19200BPS	600m

It is recommended to use shield cables and make the shield layer as the grounding wires during RS485 remote communication.

In the cases with less devices and shorter distance, it is recommended to use 120Ω terminal resistor as the performance will be weakened if the distance increase even though the network can perform well without load resistor.

10.3.2 RTU mode

10.3.2.1 RTU communication frame format

If the controller is set to communicate by RTU mode in MODBUS network every 8bit byte in the message includes two 4Bit hex characters. Compared with ACSII mode, this mode can send more data at the same baud rate.

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Code system

- 1 start bit
- 7 or 8 digital bit, the minimum valid bit can be sent firstly. Every 8 bit frame includes two hex characters (0...9, A...F)
- 1 even/odd check bit . If there is no checkout, the even/odd check bit is inexistent.
- 1 end bit (with checkout), 2 Bit(no checkout)

Error detection field

- CRC

The data format is illustrated as below:

11-bit character frame (BIT1~BIT8 are the digital bits)

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	BIT8	Check bit	End bit

10-bit character frame (BIT1~BIT7 are the digital bits)

Start bit	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	Check bit	End bit

In one character frame, the digital bit takes effect. The start bit, check bit and end bit is used to send the digital bit right to the other device. The digital bit, even/odd checkout and end bit should be set as the same in real application.

The MODBUS minimum idle time between frames should be no less than 3.5 bytes. The network device is detecting, even during the interval time, the network bus. When the first field (the address field) is received, the corresponding device decodes next transmitting character. When the interval time is at least 3.5 byte, the message ends.

The whole message frame in RTU mode is a continuous transmitting flow. If there is an interval time (more than 1.5 bytes) before the completion of the frame, the receiving device will renew the uncompleted message and suppose the next byte as the address field of the new message. As such, if the new message follows the previous one within the interval time of 3.5 bytes, the receiving device will deal with it as the same with the previous message. If these two phenomena all happen during the transmission, the CRC will generate a fault message to respond to the sending devices.

The standard structure of RTU frame:

START	T1-T2-T3-T4(transmission time of 3.5 bytes)
ADDR	Communication address: 0~247(decimal system)(0 is the broadcast address)

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CMD	03H:read slave parameters 06H:write slave parameters
DATA (N-1) ... DATA (0)	The data of 2*N bytes are the main content of the communication as well as the core of data exchanging
CRC CHK low bit	Detection value:CRC (16BIT）
CRC CHK high bit	
END	T1-T2-T3-T4(transmission time of 3.5 bytes)

10.3.2.2 RTU communication frame error checkout

Various factors (such as electromagnetic interference) may cause error in the data transmission. For example, if the sending message is a logic “1”,A-B potential difference on RS485 should be 6V, but in reality, it may be -6V because of electromagnetic interference, and then the other devices take the sent message as logic “0”. If there is no error checkout, the receiving devices will not find the message is wrong and they may give incorrect response which cause serious result. So the checkout is essential to the message.

The theme of checkout is that: the sender calculate the sending data according to a fixed formula, and then send the result with the message. When the receiver gets this message, they will calculate anther result according to the same method and compare it with the sending one. If two results are the same, the message is correct. If not, the message is incorrect.

The error checkout of the frame can be divided into two parts: the bit checkout of the byte and the whole data checkout of the frame (CRC check).

Bit checkout of the byte

The user can select different bit checkouts or non-checkout, which impacts the check bit setting of each byte.

The definition of even checkout: add an even check bit before the data transmission to illustrate the number of “1” in the data transmission is odd number or even number. When it is even, the check byte is “0”, otherwise, the check byte is”1”. This method is used to stabilize the parity of the data.

The definition of odd checkout: add an odd check bit before the data transmission to illustrate the number of “1” in the data transmission is odd number or even number. When it is odd, the check byte is “0”, otherwise, the check byte is”1”. This method is used to stabilize the parity of the data.

For example, when transmitting “11001110”, there are five “1” in the data. If the even

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checkout is applied, the even check bit is "1"; if the odd checkout is applied; the odd check bit is "0". The even and odd check bit is calculated on the check bit position of the frame. And the receiving devices also carry out even and odd checkout. If the parity of the receiving data is different from the setting value, there is an error in the communication.

CRC check

The checkout uses RTU frame format. The frame includes the frame error detection field which is based on the CRC calculation method. The CRC field is two bytes, including 16 figure binary values. It is added into the frame after calculated by transmitting device. The receiving device recalculates the CRC of the received frame and compares them with the value in the received CRC field. If the two CRC values are different, there is an error in the communication.

During CRC, 0*FFFF will be stored. And then, deal with the continuous 6-above bytes in the frame and the value in the register. Only the 8Bit data in every character is effective to CRC, while the start bit, the end and the odd and even check bit is ineffective.

The calculation of CRC applies the international standard CRC checkout principles. When the user is editing CRC calculation, he can refer to the relative standard CRC calculation to write the required CRC calculation program.

Here provided a simple function of CRC calculation for the reference (programmed with C language):

```
unsigned int crc_cal_value(unsigned char *data_value,unsigned char data_length)
{
int i;
unsigned int crc_value=0xffff;
while(data_length--)
{    crc_value^=*data_value++;
            for(i=0;i<8;i++)
            {
if(crc_value&0x0001)crc_value=(crc_value>>1)^0xa001;
            else crc_value=crc_value>>1;
            }       }
return(crc_value);
}
```

In ladder logic, CKSM calculated the CRC value according to the frame with the table inquiry. The method is advanced with easy program and quick calculation speed. But the ROM

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space the program occupied is huge. So use it with caution according to the program required space.

10.4 RTU command code and communication data illustration

10.4.1 Command code: 03H

read N words（Word）(the Max. continuous reading is 16 words)

Command code 03H means that if the master read data form the inverter, the reading number depends on the “data number” in the command code. Max. continuous reading number is 16 and the parameter address should be continuous. The byte length of every data is 2 (one word). The following command format is illustrated by hex (a number with “H” means hex) and one hex occupies one byte.

The command code is used to read the working step of the inverter.

For example, read continuous 2 data content from0004H from the inverter with the address of 01H (read the content of data address of 0004H and 0005H), the frame structure is as below:

RTU master command message (from the master to the inverter)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
High bit of the start address	00H
Low bit of the start address	04H
High bit of data number	00H
Low bit of data number	02H
CRC low bit	85H
CRC high bit	CAH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

T1-T2-T3-T4 between START and END is to provide at least the time of 3.5 bytes as the leisure time and distinguish two messages for the avoidance of taking two messages as one message.

ADDR = 01H means the command message is sent to the inverter with the address of 01H and ADDR occupies one byte

CMD=03H means the command message is sent to read data form the inverter and CMD occupies one byte

“Start address” means reading data form the address and it occupies 2 bytes with the fact

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that the high bit is in the front and the low bit is in the behind.

"Data number" means the reading data number with the unit of word. If the "start address' is 0004H and the "data number" is 0002H, the data of 0004H and 0005H will be read.

CRC occupies 2 bytes with the fact that the high bit is in the front and the low bit is in the behind.

RTU slave response message (from the inverter to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
Byte number	04H
Data high bit of address 0004H	13H
Data low bit of address 0004H	88H
Data high bit of address 0005H	00H
Data low bit of address 0005H	00H
CRC CHK low bit	7EH
CRC CHK high bit	9DH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The meaning of the response is that:

ADDR = 01H means the command message is sent to the inverter with the address of 01H and ADDR occupies one byte

CMD=03H means the message is received from the inverter to the master for the response of reading command and CMD occupies one byte

"Byte number" means all byte number from the byte(excluding the byte) to CRC byte(excluding the byte). 04 means there are 4 byte of data from the "byte number" to "CRC CHK low bit", which are "digital address 0004H high bit", "digital address 0004H low bit", "digital address 0005H high bit" and "digital address 0005H low bit".

There are 2 bytes stored in one data with the fact that the high bit is in the front and the low bit is in the behind of the message, the data of data address 0004H is 1388H, and the data of data address 0005H is 0000H.

CRC occupies 2 bytes with the fact that the high bit is in the front and the low bit is in the behind.

10.4.2 Command code: 06H

06H (correspond to binary 0000 0110), write one word(Word)

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The command means that the master write data to the inverter and one command can write one data other than multiple dates. The effect is to change the working mode of the inverter. For example, write 5000 (1388H) to 0004H from the inverter with the address of 02H, the frame structure is as below:

RTU master command message (from the master to the inverter)

START	T1-T2-T3-T4(transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
High bit of write data address	00H
Low bit of write data address	04H
High bit of data content	13H
Low bit of data content	88H
CRC CHK low bit	C5H
CRC CHK high bit	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU slave response message (from the inverter to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
High bit of writing data address	00H
Low bit of writing data address	04H
High bit of data content	13H
Low bit of data content	88H
CRC CHK low bit	C5H
CRC CHK high bit	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Note: section 10.2 and 10.3 mainly describe the command format, and the detailed application will be mentioned in 10.8 with examples.

10.4.3 Command code 08H for diagnosis

Meaning of sub-function codes

Sub-function Code	Description
0000	Return to inquire information data

For example: The inquiry information string is same as the response information string when

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the loop detection to address 01H of driver is carried out.

The RTU request command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
High bit of sub-function code	00H
Low bit of sub-function code	00H
High bit of data content	12H
Low bit of data content	ABH
Low bit of CRC	ADH
High bit of CRC	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The RTU response command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
High bit of sub-function code	00H
Low bit of sub-function code	00H
High bit of data content	12H
Low bit of data content	ABH
Low bit of CRC	ADH
High bit of CRC	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

10.4.4 Command code: 10H, continuous writing

Command code 10H means that if the master writes data to the inverter, the data number depends on the “data number” in the command code. The Max. continuous reading number is 16.

For example, write 5000(1388H) to 0004H of the inverter whose slave address is 02H and 50(0032H) to 0005H, the frame structure is as below:

The RTU request command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H

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High bit of write data	00H
Low bit of write data	04H
High bit of data number	00H
Low bit of data number	02H
Byte number	04H
High bit of data 0004H	13H
Low bit of data 0004H	88H
High bit of data 0005H	00H
Low bit of data 0005H	32H
Low bit of CRC	C5H
High bit of CRC	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The RTU response command is:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	10H
High bit of write data	00H
Low bit of write data	04H
High bit of data number	00H
Low bit of data number	02H
Low bit of CRC	C5H
High bit of CRC	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

10.4.5 The definition of data address

The address definition of the communication data in this part is to control the running of the inverter and get the state information and relative function parameters of the inverter.

10.4.5.1 The rules of parameter address of the function codes

The parameter address occupies 2 bytes with the fact that the high bit is in the front and the low bit is in the behind. The range of high and low byte are: high byte—00~ffH; low byte—00~ffH. The high byte is the group number before the radix point of the function code and the low byte is the number after the radix point. But both the high byte and the low byte should be changed into hex. For example P05.06, the group number before the radix point of the function code is 05, then the high bit of the parameter is 05, the number after the radix point 05, then the low bit of the parameter is 06, then t he function code address is 0506H and the parameter address of P10.01 is 0A01H.

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Function code	Name	Detailed instruction of parameters	Setting range	Default value	Modification	Serial No.
P10.00	Simple PLC means	0：Stop after running once. 1：Run at the final value after running once. 2：Cycle running.	0~2	0	○	354
P10.01	Simple PLC memory selection	0：power loss without memory 1：power loss memory；	0~1	0	○	355

Note: P29 group is the factory parameter which can not be read or changed. Some parameters can not be changed when the inverter is in the running state and some parameters can not be changed in any state. The setting range, unit and relative instructions should be paid attention to when modifying the function code parameters.

Besides, EEPROM is stocked frequently, which may shorten the usage time of EEPROM. For users, some functions are not necessary to be stocked on the communication mode. The needs can be met on by changing the value in RAM. Changing the high bit of the function code form 0 to 1 can also realize the function. For example, the function code P00.07 is not stocked into EEPROM. Only by changing the value in RAM can set the address to 8007H. This address can only be used in writing RAM other than reading. If it is used to read, it is an invalid address.

10.4.5.2 The address instruction of other function in MODBUS

The master can operate on the parameters of the inverter as well as control the inverter, such as running or stopping and monitoring the working state of the inverter.

Below is the parameter list of other functions

Function instruction	Address definition	Data meaning instruction	R/W characteristics
Communication control command	2000H	0001H:forward running	W/R
		0002H:reverse running	
		0003H:forward jogging	
		0004H:reverse jogging	
		0005H:stop	
		0006H:coast to stop (emergency stop)	
		0007H:fault reset	
		0008H:jogging stop	
The address of the communication n setting value	2001H	Communication setting frequency(0~Fmax(unit: 0.01Hz))	W/R
	2002H	PID reference, range(0~1000, 1000 corresponds to100.0%)	
	2003H	PID feedback, range(0~1000, 1000 corresponds to100.0%)	W/R
	2004H	Torque setting value (-3000~3000, 1000	W/R

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Function instruction	Address definition	Data meaning instruction	R/W characteristics
		corresponds to the 100.0% of the rated current of the motor)	
	2005H	The upper limit frequency setting during forward rotation(0~Fmax(unit: 0.01Hz))	W/R
	2006H	The upper limit frequency setting during reverse rotation(0~Fmax(unit: 0.01Hz))	W/R
	2007H	The upper limit torque of electromotion torque (0~3000, 1000 corresponds to the 100.0% of the rated current of the motor)	W/R
	2008H	The upper limit torque of braking torque (0~3000, 1000 corresponds to the 100.0% of the rated current of the motor)	W/R
	2009H	Special control command word Bit0~1:=00:motor 1 =01:motor 2 =10:motor 3 =11:motor 4 Bit2:=1 torque control =0:speed control	W/R
	200AH	Virtual input terminal command , range: 0x000~0x1FF	W/R
	200BH	Virtual input terminal command , range: 0x00~0x0F	W/R
	200CH	Voltage setting value(special for V/F separation) (0~1000, 1000 corresponds to the 100.0% of the rated voltage of the motor)	W/R
	200DH	AO output setting 1(-1000~1000, 1000 corresponds to 100.0%)	W/R
	200EH	AO output setting 2(-1000~1000, 1000 corresponds to 100.0%)	W/R
SW 1 of the inverter	2100H	0001H:forward running	R
		0002H:forward running	
		0003H:stop	
		0004H:fault	
		0005H: POFF state	
SW 2 of the inverter	2101H	Bit0: =0:bus voltage is not established =1:bus voltage is established Bi1~2:=00:motor 1 =01:motor 2 =10:motor 3 =11:motor 4 Bit3: =0:asynchronous motor =1:synchronous motor Bit4:=0:pre-alarm without overload	R

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Function instruction	Address definition	Data meaning instruction	R/W characteristics
		=1:overload pre-alarm Bit5~ Bit6:=00:keypad control =01:terminal control =10:commuincation control	
Fault code of the inverter	2102H	See the fault type instruction	R
Identifying code of the inverter	2103H	GD200-----0x010C	R
Operation frequency	3000H	Range: 0.00Hz~P00.03	R
Setting frequency	3001H	Range: 0.00Hz~P00.03	R
Bus voltage	3002H	Range: 0~1200V	R
Output voltage	3003H	Range: 0~1200V	R
Output current	3004H	Range: 0.0~5000.0A	R
Operation speed	3005H	Range: 0~65535RPM	R
Output power	3006H	Range: -300.0~300.0%	R
Output torque	3007H	Range: 0~65535RPM	R
Close loop setting	3008H	Range: -100.0%~100.0%	R
Close loop feedback	3009H	Range: -100.0%~100.0%	R
Input IO state	300AH	Range: 0000~00FF	R
Output IO state	300BH	Range: 0000~00FF	R
AI 1	300CH	Range: 0.00~10.00V	R
AI 2	300DH	Range: 0.00~10.00V	R
AI 3	300EH	Range: 0.00~10.00V	R
AI 4	300FH	Reserved	R
Read high speed pulse 1 input	3010H	Range: 0.00~50.00kHz	R
Read high speed pulse 2 input	3011H	Reserved	R
Read current step of the multi-step speed	3012H	Range: 0~15	R
External length	3013H	Range: 0~65535	R
External counting value	3014H	Range: 0~65535	R
Torque setting	3015H	Range: 0~65535	R
Inverter code	3016H		R

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Function instruction	Address definition	Data meaning instruction	R/W characteristics
Fault code	5000H		R

R/W characteristics means the function is with read and write characteristics. For example, "communication control command" is writing chrematistics and control the inverter with writing command (06H). R characteristic can only read other than write and W characteristic can only write other than read.

Note: when operate on the inverter with the table above, it is necessary to enable some parameters. For example, the operation of running and stopping, it is necessary to set P00.01 to communication running command channel and set P00.02 to MODBUS communication channel. And when operate on "PID reference", it is necessary to set P09.00 to "MODBUS communication setting".

The encoding rules for device codes (corresponds to identifying code 2103H of the inverter)

Code high 8 bit	Meaning	Code low 8 bit	Meaning
01	GD	0x08	GD35 vector inverters
		0x09	GD35-H1 vector inverters
		0x0a	GD300 vector inverters
		0x0b	GD100 simple vector inverters
		0x0c	GD200 general inverters
		0x0d	GD10 mini inverters

Note: the code is consisted of 16 bit which is high 8 bits and low 8 bits. High 8 bits mean the motor type series and low 8 bits mean the derived motor types of the series. For example, 0110H means Goodrive200 vector inverters.

10.4.6 Fieldbus ratio values

The communication data is expressed by hex in actual application and there is no radix point in hex. For example, 50.12Hz can not be expressed by hex so 50.12 can be magnified by 100 times into 5012, so hex 1394H can be used to express 50.12.

A non-integer can be timed by a multiple to get an integer and the integer can be called fieldbus ratio values.

The fieldbus ratio values are referred to the radix point of the setting range or default value in the function parameter list. If there are figures behind the radix point (n=1), then the fieldbus ratio value m is 10^n. Take the table as the example:

Function code	Name	Detailed instruction of parameters	Setting range	Default value	Modification	Serial No.
P01.20	Hibernation restore delay time	Setting range: 0.0~3600.0s (valid when P01.19=2)	0.0~3600.0	0.0s	○	39
P01.21	Restart after power off	0: disabling 1: enabling	0~1	0	○	40

If there is one figure behind the radix point in the setting range or the default value, then the fieldbus ratio value is 10. if the data received by the upper monitor is 50, then the

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"hibernation restore delay time" is 5.0 (5.0=50÷10).

If MODBUS communication is used to control the hibernation restore delay time as 5.0s. Firstly, 5.0 can be magnified by 10 times to integer 50 (32H) and then this data can be sent.

01	06	01 14	00 32	49 E7
inverter address	read command	parameters address	data number	CRC check

After the inverter receives the command, it will change 50 into 5 according to the fieldbus ratio value and then set the hibernation restore delay time as 5s.

Another example, after the upper monitor sends the command of reading the parameter of hibernation restore delay time ,if the response message of the inverter is as following:

01	03	02	00 32	39 91
inverter address	read command	2 bytes data	parameter data	CRC check

Because the parameter data is 0032H (50) and 50 divided by 10 is 5, then the hibernation restore delay time is 5s.

10.4.7 Fault message response

There may be fault in the communication control. For example, some parameter can only be read. If a writing message is sent, the inverter will return a fault response message.

The fault message is from the inverter to the master, its code and meaning is as below:

Code	Name	Meaning
01H	Illegal command	The command from master can not be executed. The reason maybe: 1. This command is only for new version and this version can not realize. 2. Slave is in fault state and can not execute it.
02H	Illegal data address.	Some of the operation addresses are invalid or not allowed to access. Especially the combination of the register and the transmitting bytes are invalid.
03H	Illegal value	When there are invalid data in the message framed received by slave. **Note:** This error code does not indicate the data value to write exceed the range, but indicate the message frame is an illegal frame.
04H	Operation failed	The parameter setting in parameter writing is invalid. For example, the function input terminal can not be set repeatedly.
05H	Password error	The password written to the password check address is not same as the password set by P7.00.
06H	Data frame error	In the frame message sent by the upper monitor, the length of the digital frame is incorrect or the counting of CRC check bit in RTU is different from the lower monitor.
07H	Written not allowed.	It only happen in write command, the reason maybe: 1. The written data exceeds the parameter range.

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		2. The parameter should not be modified now. 3. The terminal has already been used.
08H	The parameter can not be changed during running	The modified parameter in the writing of the upper monitor can not be modified during running.
09H	Password protection	When the upper monitor is writing or reading and the user password is set without password unlocking, it will report that the system is locked.

The slave uses functional code fields and fault addresses to indicate it is a normal response or some error occurs (named as objection response). For normal responses, the slave shows corresponding function codes, digital address or sub-function codes as the response. For objection responses, the slave returns a code which equals the normal code, but the first byte is logic 1.

For example: when the master sends a message to the slave, requiring it to read a group of address data of the inverter function codes, there will be following function codes:

0 0 0 0 0 0 1 1 (Hex 03H)

For normal responses, the slave responds the same codes, while for objection responses, it will return:

1 0 0 0 0 0 1 1 (Hex 83H)

Besides the function codes modification for the objection fault, the slave will respond a byte of abnormal code which defines the error reason.

When the master receives the response for the objection, in a typical processing, it will send the message again or modify the corresponding order.

For example, set the "running command channel" of the inverter (P00.01, parameter address is 0001H) with the address of 01H to 03, the command is as following:

01	06	00 01	00 03	98 0B
inverter address	read command	parameter address	parameter data	CRC check

But the setting range of "running command channel" is 0~2, if it is set to 3, because the number is beyond the range, the inverter will return fault response message as below:

01	86	04	43 A3
inverter address	abnormal response code	fault code	CRC check

Abnormal response code 86H means the abnormal response to writing command 06H; the fault code is 04H. In the table above, its name is operation failed and its meaning is that the parameter setting in parameter writing is invalid. For example, the function input terminal can not be set repeatedly.

10.4.8 Example of writing and reading

Refer to 10.4.1 and 10.4.2 for the command format.

10.4.8.1 Example of reading command 03H

Read the state word 1 of the inverter with the address of 01H (refer to table 1). From the table 1, the parameter address of the state word 1 of the inverter is 2100H.

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The command sent to the inverter:

01	03	21 00	00 01	8E 36
inverter address	read parameter	parameter address	data number	CRC check

If the response message is as below:

01	03	02	00 03	F8 45
inverter address	read command	data number	data content	CRC check

The data content is 0003H. From the table 1, the inverter stops.

Watch “the current fault type” to “the previous 5 times fault type” of the inverter through commands, the corresponding function code is P07.27~P07.32 and corresponding parameter address is 071BH~0720H(there are 6 from 071BH).

The command sent to the inverter:

03	03	07 1B	00 06	B5 59
inverter address	read command	start address	total 6 parameters	CRC check

If the response message is as below:

03	03	0C	00 23	00 23	00 23	00 23	00 23	00 23	5F D2
Inverter address	Read command	Byte number	Current fault type	Previous fault type	Previous 2 fault type	Previous 3 fault type	Previous 4 fault type	Previous 5 fault type	CRC check

See from the returned data, all fault types are 0023H (decimal 35) with the meaning of maladjustment (STo).

10.4.8.2 Example of writing command 06H

Make the inverter with the address of 03H to run forward. See table 1, the address of “communication control command” is 2000H and forward running is 0001. See the table below.

Function instruction	Address definition	Data meaning instruction	R/W characteristics
Communication control command	2000H	0001H: forward running	W
		0002H: reverse running	
		0003H: forward jogging	
		0004H: reverse jogging	
		0005H: stop	
		0006H: coast to stop (emergency stop)	
		0007H: fault reset	
		0008H: jogging stop	
		0009H: pre-exciting	

The command sent by the master:

03	06	20 00	00 01	42 28
inverter address	write command	parameter address	forward running	CRC check

If the operation is success, the response may be as below (the same with the command sent by the master):

03	06	20 00	00 01	42 28
inverter address	write command	parameter address	forward running	CRC check

Set the Max. Output frequency of the inverter with the address of 03H as100Hz.

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P00.03	Max. output frequency	Setting range : P00.04~600.00Hz(400.00 Hz)	10.00~600.00	50.00Hz	◎	3.

See the figures behind the radix point, the fieldbus ratio value of the Max. output frequency (P00.03) is 100. 100Hz timed by 100 is 10000 and the corresponding hex is 2710H.
The command sent by the master:

03	06	00 03	27 10	62 14
inverter address	write command	parameter address	forward running	CRC check

If the operation is successful, the response may be as below (the same with the command sent by the master):

03	06	00 03	27 10	62 14
inverter address	write command	parameter address	forward running	CRC check

Note: the blank in the above command is for illustration. The blank can not be added in the actual application unless the upper monitor can remove the blank by themselves.

Common communication fault

Common communication faults are: no response to the communication or the inverter returns abnormal fault.

The possible reason for no response to the communication:

Selecting wrong serial interface, for example, if the converter is COM1, selecting COM2 during the communication

The baud rate, digital bit, end bit and check bit are not the same with the inverter + and - of RS485 are connected in reverse.

The 485 wire cap on the terminal board of the inverter is not plug in. the wire cap in behind the terminal arrangement.

10.4.8.3 Example of continous writing command10H

Example 1: make the inverter whose address is 01H run forward at 10Hz. Refer to the instruction of 2000H and 0001. Set the address of “communication setting frequency” is 2001H and 10Hz corresponds to 03E8H. See the table below.

Function instruction	Address definition	Data meaning instruction	R/W characteristics
Communication control command	2000H	0001H:forward running	W/R
		0002H:reverse running	
		0003H:forward jogging	
		0004H:reverse jogging	
		0005H:stop	
		0006H:coast to stop (emergency stop)	
		0007H:fault reset	
		0008H:jogging stop	
The address of	2001H	Communication setting	W/R

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Function instruction	Address definition	Data meaning instruction	R/W characteristics
communication setting		frequency(0~Fmax(unit: 0.01Hz))	
	2002H	PID given, range(0~1000, 1000 corresponds to100.0%)	

Set P00.01 to 2 and P00.06 to 8.

The command sent to the inverter:

01	10	20 00	00 02	04	00 01	03 E8	3B 10
Inverter address	Continuous writing command	Parameters address	Data number	Byte number	Forward running	10Hz	CRC check

If the response message is as below:

01	10	20 00	00 02	4A 08
Inverter address	Continuous writing command	Parameters address	Data number	CRC check

Example 2: set the ACC time of 01H inverter as 10s and the DEC time as 20s

P00.11	ACC time 1	ACC time means the time needed if the inverter speeds up from 0Hz to the Max. One (P00.03). DEC time means the time needed if the inverter speeds down from the Max. Output frequency to 0Hz (P00.03). Goodrive300 series inverters define four groups of ACC/DEC time which can be selected by P05. The factory default ACC/DEC time of the inverter is the first group. Setting range of P00.11 and P00.12:0.0~3600.0s	Depend on model	○
P00.12	DEC time 1		Depend on model	○

The corresponding address of P00.11 is 000B, the ACC time of 10s corresponds to 0064H, and the DEC time of 20s corresponds to 00C8H.

The command sent to the inverter:

01	10	00 0B	00 02	04	00 64	00 C8	F2 55
Inverter address	Continuous writing command	Parameters address	Data number	Byte number	10s	20s	CRC check

If the response message is as below:

01	10	00 0B	00 02	30 0A
Inverter address	Continuous writing command	Parameters address	Data number	CRC check

Note: The space between above commands is for instruction and there is no space between the commands during actual applications.

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Technical Data Appendix A

A.1 What this chapter contains

This chapter contains the technical specifications of the inverter, as well as provisions for fulfilling the requirements for CE and other marks.

A.2 Ratings

A.2.1 Capacity

Inverter sizing is based on the rated motor current and power. To achieve the rated motor power reference in the table, the rated current of the inverter must be higher than or equal to the rated motor current. Also the rated power of the inverter must be higher than or equal to the rated motor power. The power ratings are the same regardless of the supply voltage within one voltage range.

Note:

1. The maximum allowed motor shaft power is limited to 1.5 · PN. If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload.

2. The ratings apply at ambient temperature of 40 °C

3. It is important to check that in Common DC systems the power flowing through the common DC connection does not exceed PN.

A.2.2 Derating

The load capacity decreases if the installation site ambient temperature exceeds 40 °C, the altitude exceeds 1000 meters or the switching frequency is changed from 4 kHz to 8, 12 or 15 kHz.

A.2.2.1 Temperature derating

In the temperature range +40 °C…+50 °C, the rated output current is decreased by 1% for every additional 1 °C. Refer to the below list for the actual derating.

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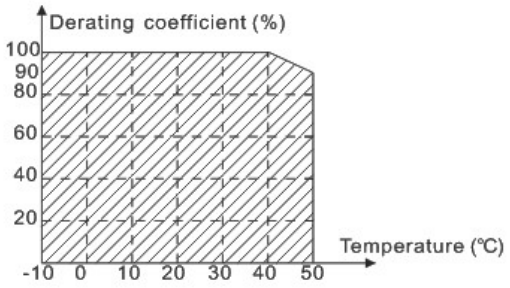
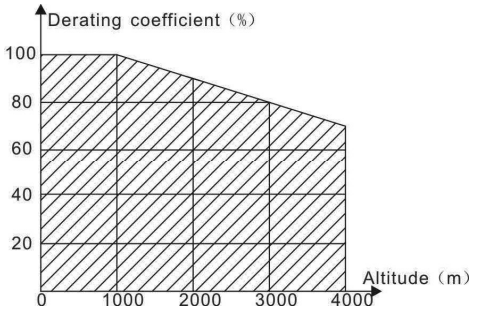


A.2.2.2 Altitude derating

The device can output rated power if the installation site below 1000m. The output power decreases if the altitude exceeds 1000 meters. Below is the detailed decreasing range of the derating:



For 3-phase 200 V drives, the maximum altitude is 3000m above sea level. In altitudes 2000…3000 m, the derating is 1% for every 100 m.

A.2.2.3 Carrier frequency derating

For Goodrive200 series inverters, different power level corresponds to different carrier frequency range. The rated power of the inverter is based on the factory carrier frequency, so if it is above the factory value, the inverter needs to derate 10% for every additional 1 kHz carrier frequency.

A.3 Electric power network specification

Voltage	AC 3PH 220(-15%)~240(+10%) AC 3PH 380(-15%)~440(+10%) AC 3PH 520(-15%)~690(+10%)
Short-circuit capacity	Maximum allowed prospective short-circuit current at the input power connection as defined in IEC 60439-1 is 100 kA. The drive is suitable for use in a circuit capable of delivering not more than 100

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	kA at the drive maximum rated voltage.
Frequency	50/60 Hz ± 5%, maximum rate of change 20%/s

A.4 Motor connection data

Motor type	Asynchronous inductance motor
Voltage	0 to U1, 3-phase symmetrical, Umax at the field weakening point
Short-circuit protection	The motor output is short-circuit proof by IEC 61800-5-1
Frequency	0...400 Hz
Frequency resolution	0.01 Hz
Current	Refer to Ratings
Power limit	1.5 · PN
Field weakening point	10...400 Hz
Carrier frequency	4, 8, 12 or 15 kHz

A.4.1 EMC compatibility and motor cable length

To comply with the European EMC Directive (standard IEC/EN 61800-3), use the following maximum motor cable lengths for 4 kHz switching frequency.

All frame sizes	Maximum motor cable length, 4 kHz
Second environment (category C3)	30
first environment (category C2)	30

Maximum motor cable length is determined by the drive's operational factors. Contact your local INVT representative for the exact maximum lengths when using external EMC filters.

A.5 Applicable standards

The inverter complies with the following standards:

EN ISO 13849-1: 2008	Safety of machinery-safety related parts of control systems - Part 1: general principles for design
IEC/EN 60204-1:2006	Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
IEC/EN 62061: 2005	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems

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IEC/EN 61800-3:2004	Adjustable speed electrical power drives systems. Part 3: EMC requirements and specific test methods
IEC/EN 61800-5-1:2007	Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy
IEC/EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements. Functional.

A.5.1 CE marking

The CE mark is attached to the drive to verify that the drive follows the provisions of the European Low Voltage (2006/95/EC) and EMC Directives (2004/108/EC).

A.5.2 Compliance with the European EMC Directive

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (EN 61800-3:2004) covers requirements stated for drives. See section *EMC regulations*

A.6 EMC regulations

EMC product standard (EN 61800-3:2004) contains the EMC requirements to the inverter.

First environment: domestic environment (includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes).

Second environment includes establishments connected to a network not directly supplying domestic premises.

Four categories of the inverter:

Inverter of category C1: inverter of rated voltage less than 1000 V and used in the first environment.

Inverter of category C2: inverter of rated voltage less than 1000 V other than pins, sockets and motion devices and intended to be installed and commissioned only by a professional electrician when used in the first environment.

Note: IEC/EN 61800-3 in EMC standard doesn't limit the power distribution of the inverter, but it defines the step, installation and commission. The professional electrician has necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

Inverter of category C3: inverter of rated voltage less than 1000 V and used in the second environment other than the first one

Inverter of category C4: inverter of rated voltage more than 1000 V or the rated current is above or equal to 400A and used in the complicated system in second environment

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A.6.1 Category C2

The emission limits are complied with the following provisions:

1. The optional EMC filter is selected according to the options and installed as specified in the EMC filter manual.
2. The motor and control cables are selected as specified in this manual.
3. The drive is installed according to the instructions reference in this manual.
4. For the maximum motor cable length with 4 kHz switching frequency, see ***EMC compatibility and motor cable length***

	✧**In a domestic environment, this product may cause radio inference, in which case supplementary mitigation measures may be required.**

A.6.2 Category C3

The immunity performance of the drive complies with the demands of IEC/EN 61800-3, second environment.

The emission limits are complied with the following provisions:

1. The optional EMC filter is selected according to the options and installed as specified in the EMC filter manual.
2. The motor and control cables are selected as specified in this manual.
3. The drive is installed according to the instructions reference in this manual.
4. For the maximum motor cable length with 4 kHz switching frequency, see ***EMC compatibility and motor cable length***

	✧**A drive of category C3 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.**

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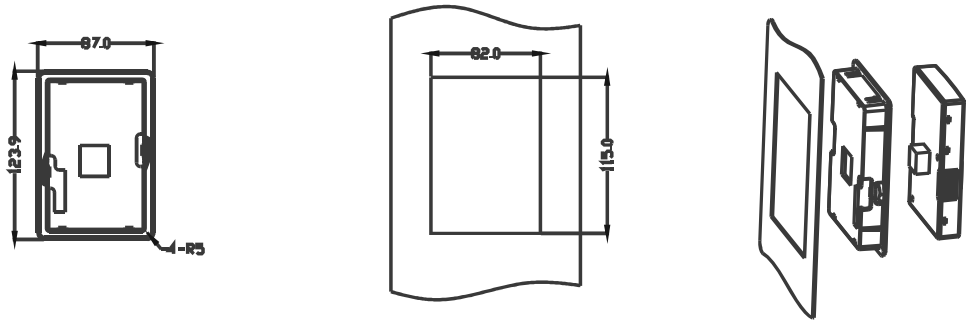
Dimension Drawings Appendix B

B.1 What this chapter contains

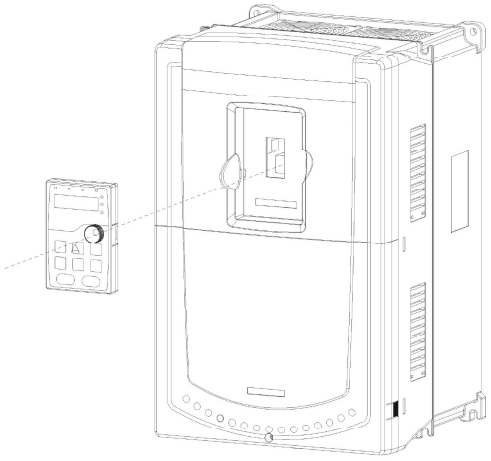
Dimension drawings of the Goodrive200 are shown below. The dimensions are reference in millimeters and inches.

B.2 Keypad structure

B.2.1 Structure chart



B.2.2 Installation chart



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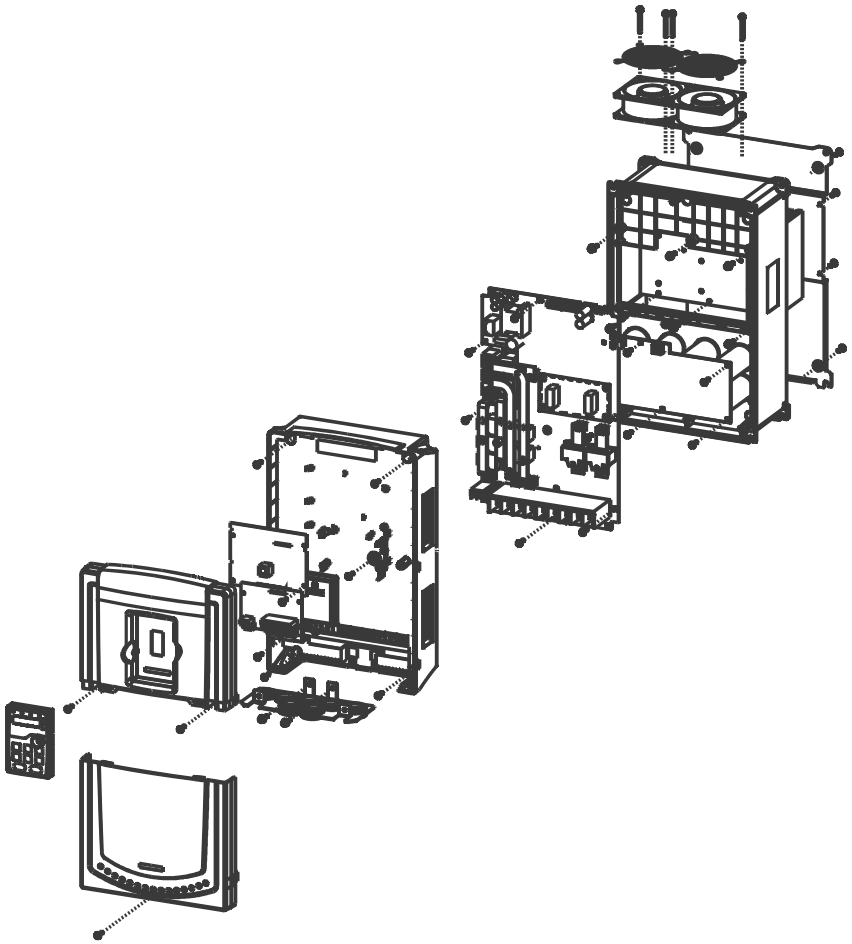
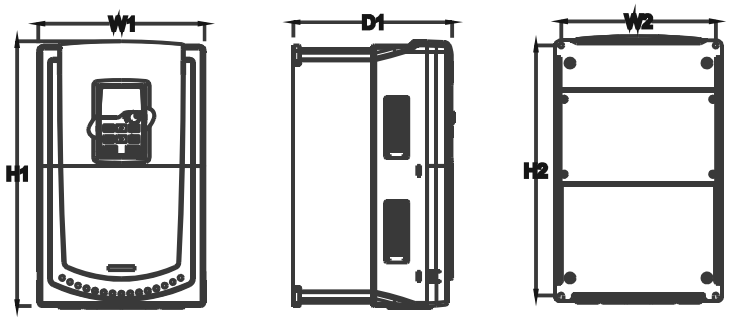
B.3 Inverter chart



B.4 Inverter chart

B.4.1 Wall mounting



1.5-30kW wall mounting

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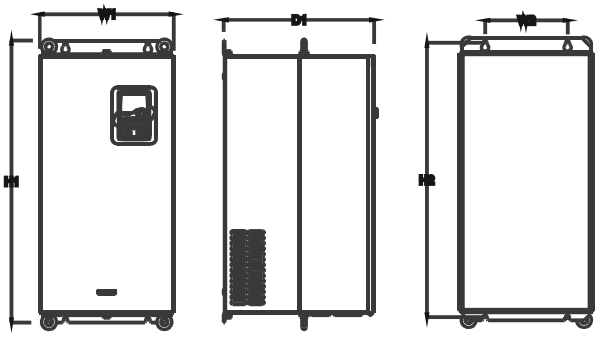
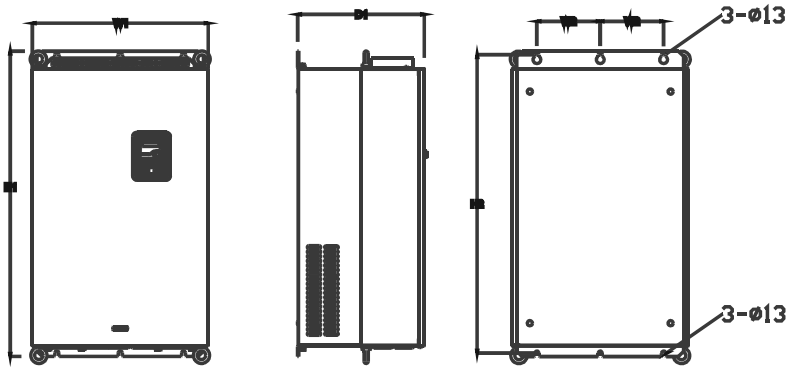
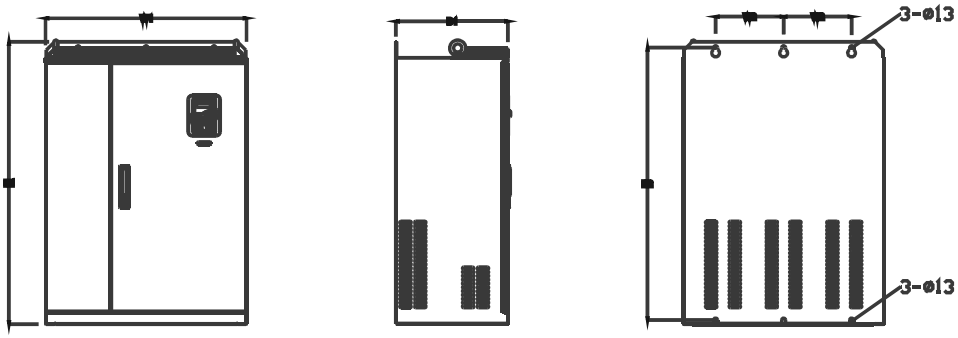


37-110kW wall mounting



132-200kW wall mounting



220-315kW wall mounting

Installation dimension (unit: mm)

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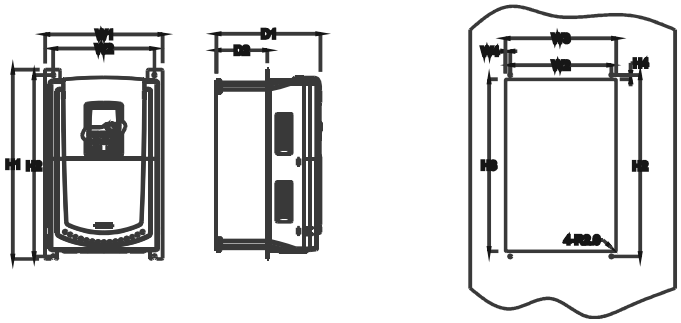
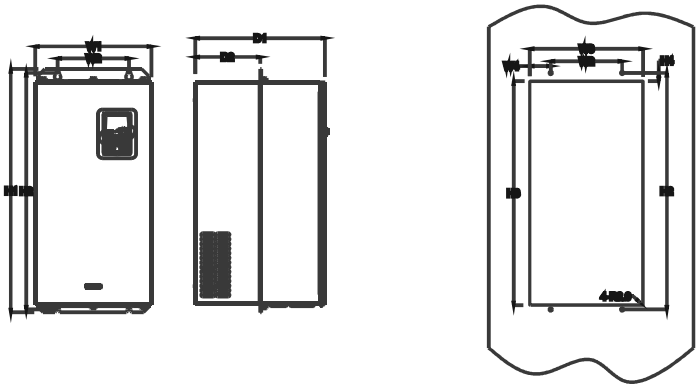
Model	W1	W2	H1	H2	D1	Installation hole
1.5kW~2.2kW	126	115	193	175	174.5	5
4kW~5.5kW	146	131	263	243.5	181	6
7.5kW~11kW	170	151	331.5	303.5	216	6
15kW~18.5kW	230	210	342	311	216	6
22kW~30kW	255	237	407	384	245	7
37kW~55kW	270	130	555	540	325	7
75kW~110kW	325	200	680	661	365	9.5
132kW~200kW	500	180	870	850	360	11
220kW~315kW	680	230	960	926	379.5	13

B.4.2 Flange mounting



1.5-30kW flange mounting



37-110kW flange mounting

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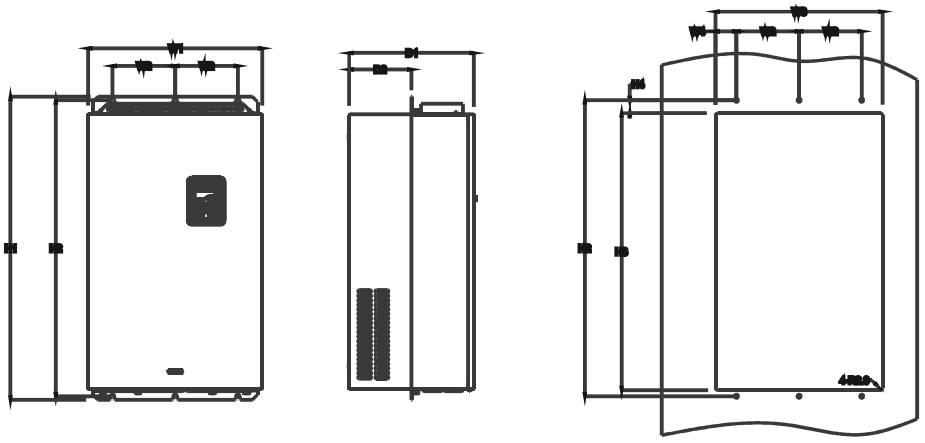
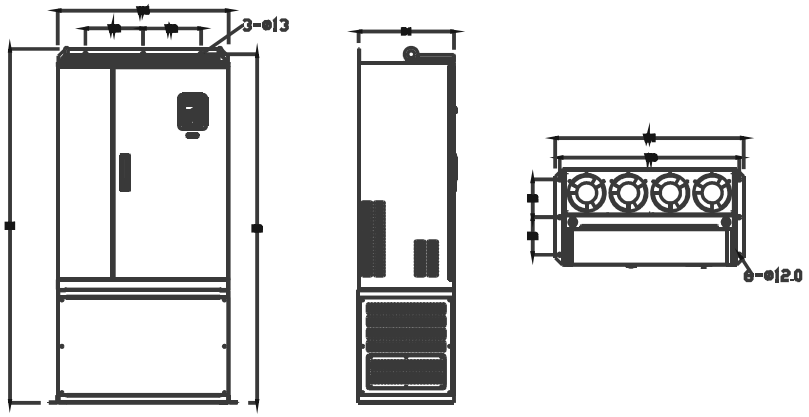


132-200kW flange mounting

Installation dimension (unit: mm)

Model	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	Installation hole
1.5kW~2.2kW	150	115	130	7.5	234	220	190	16.5	174.5	65.5	5
4kW~5.5kW	170	131	150	9.5	292	276	260	10	181	79.5	6
7.5kW~11kW	191	151	174	11.5	370	351	324	15	216.2	113	6
15kW~18.5kW	250	210	234	12	375	356	334	10	216	108	6
22kW~30kW	275	237	259	11	445	426	404	10	245	119	7
37kW~55kW	270	130	261	65.5	555	540	516	17	325	167	7
75kW~110kW	325	200	317	58.5	680	661	626	23	363	182	9.5
132kW~200kW	500	180	480	60	870	850	796	37	358	178.5	11

B.4.3 Floor mounting



220-315kW floor mounting

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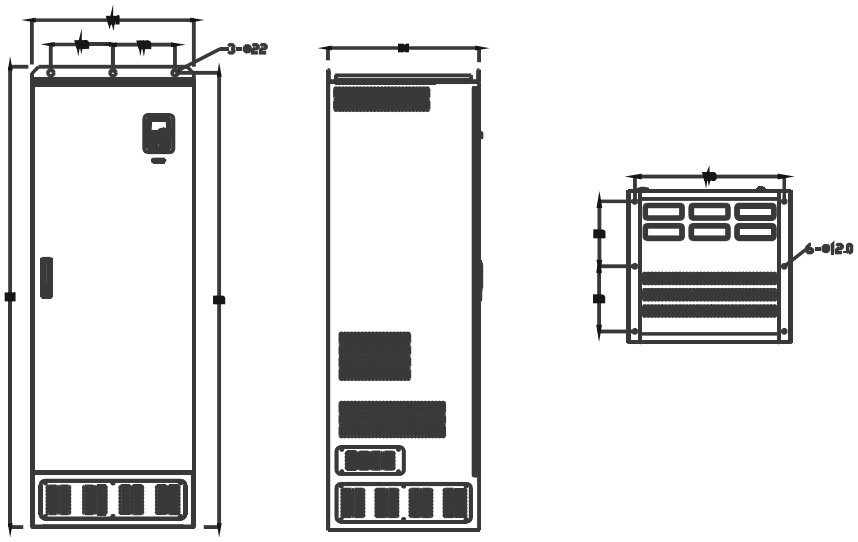

50-500kW floor mounting

Model	W1	W2	W3	W4	H1	H2	D1	D2	Installation hole
220kW~315kW	750	230	714	680	1410	1390	380	150	13\12
350kW~500kW	620	230	573	\	1700	1678	560	240	22\12

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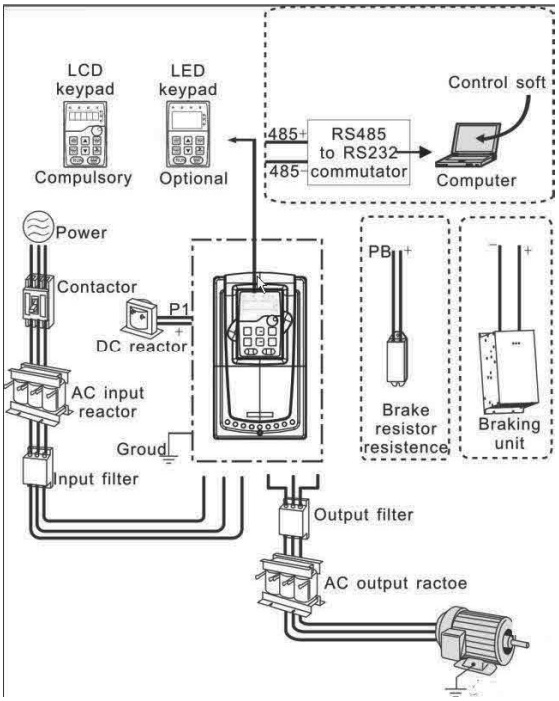
Peripheral Options and Parts Appendix C

C.1 What this chapter contains

This chapter describes how to select the options and parts of Goodrive200 series.

C.2 Peripheral wiring

Below is the peripheral wiring of Goodrive200 series inverters.



Note:

1. The inverter below 30kW (including 30kW) are embedded with braking unit.

2. Only the inverter above 37kW (including 37kW) have P1 terminal and are connected with DC reactors.

3. The braking units apply standard braking unit DBU series in. Refer to the instruction of DBU for detailed information.

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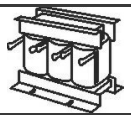
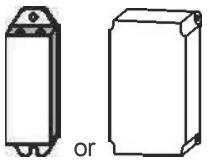
Pictures	Name	Descriptions
	Cables	Device to transfer the electronic signals
	Breaker	Prevent from electric shock and protect the power supply and the cables system from overcurrent when short circuits occur. (Please select the breaker with the function of reducing high order harmonic and the rated sensitive current to 1 inverter should be above 30mA).
	Input reactor	This device is used to improve the power factor of the input side of the inverter and control the higher harmonic current. The inverter above 37kW (including 37kW) can be connected with DC reactor.
	DC reactor	
	Input filter	Control the electromagnetic interference generated from the inverter, please install close to the input terminal side of the inverter.
 or	Braking unit or resistors	Shorten the DEC time The inverters below 30kW(including 30kW) only need braking resistors and the inverters above 37kW(including 37 kW) need braking units
	Output filter	Control the interference from the output side of the inverter and please install close to the output terminals of the inverter.
	Output reactor	Prolong the effective transmitting distance of the inverter to control the sudden high voltage when switching on/off the IGBT of the inverter.

C.3 Power supply

Please refer to ***Electronical Installation***.

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	✧**Check that the voltage degree of the inverter complies with the voltage of the supply power voltage.**

C.4 Cables

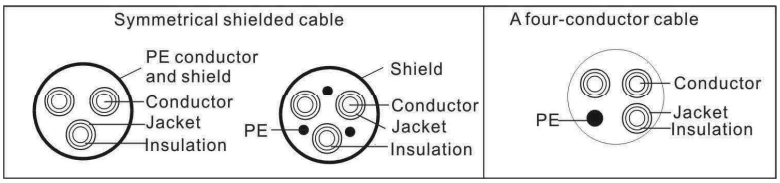
C.4.1 Power cables

Dimension the input power and motor cables according to local regulations.

- The input power and the motor cables must be able to carry the corresponding load currents.
- The cable must be rated for at least 70 °C maximum permissible temperature of the conductor in continuous use.
- The conductivity of the PE conductor must be equal to that of the phase conductor (same cross-sectional area).
- Refer to chapter ***Technical Data*** for the EMC requirements.

A symmetrical shielded motor cable (see the figure below) must be used to meet the EMC requirements of the CE.

A four-conductor system is allowed for input cabling, but a shielded symmetrical cable is recommended. Compared to a four-conductor system, the use of a symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as motor bearing currents and wear.



Note: A separate PE conductor is required if the conductivity of the cable shield is not sufficient for the purpose.

To function as a protective conductor, the shield must have the same cross-sectional area as the phase conductors when they are made of the same metal.

To effectively suppress radiated and conducted radio-frequency emissions, the shield conductivity must be at least 1/10 of the phase conductor conductivity. The requirements are easily met with a copper or aluminum shield. The minimum requirement of the motor cable shield of the drive is shown below. It consists of a concentric layer of copper wires. The better and tighter the shield, the lower the emission level and bearing currents.

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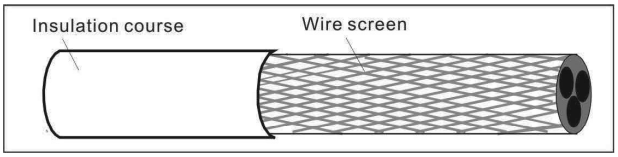
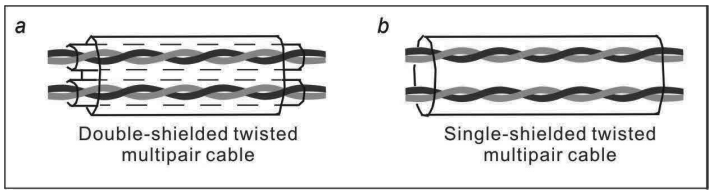


C.4.2 Control cables

All analog control cables and the cable used for the frequency input must be shielded. Use a double-shielded twisted pair cable (Figure a) for analog signals. Employ one individually shielded pair for each signal. Do not use common return for different analog signals.



A double-shielded cable is the best alternative for low-voltage digital signals, but a single-shielded or unshielded twisted multi-pair cable (Figure b) is also usable. However, for frequency input, always use a shielded cable.

Note: Run analog and digital signals in separate cables.

The relay cable needs the cable type with braided metallic screen.

The keypad needs to connect with cables. It is recommended to use the screen cable on complex electrical magnetic condition.

Note: Run analog and digital signals in separate cables.

Do not make any voltage tolerance or insulation resistance tests (for example hi-pot or megger) on any part of the drive as testing can damage the drive. Every drive has been tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

Check the insulation of the input power cable according to local regulations before connecting to the drive.

Note:

1. It is appropriate to use the recommended cable size under 40℃ and rated current. The wiring distance should be no more than 100m.
2. Terminals P1, (+), PB and (-) connects the DC reactor options and parts.

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The inverter	Recommended cable size(mm^2)				Screw	
	R,S,T U,V,W	PE	P1(+)	PB(+)(-)	Terminal screw size	Tightening torque (Nm)
GD200-1R5G-4	2.5	2.5	2.5	2.5	M4	1.2~1.5
GD200-2R2G-4	2.5	2.5	2.5	2.5	M4	1.2~1.5
GD200-004G/5R5P-4	2.5	2.5	2.5	2.5	M4	1.2~1.5
GD200-5R5G/7R5P-4	4	4	2.5	2.5	M5	2-~2.5
GD200-7R5G/011P-4	6	6	4	2.5	M5	2-~2.5
GD200-011G/015P-4	10	10	6	4	M5	2-~2.5
GD200-015G/018P-4	10	10	10	4	M5	2-~2.5
GD200-018G/022P-4	16	16	10	6	M6	4~6
GD200-022G/030P-4	25	16	16	10	M6	4~6
GD200-030G/037P-4	25	16	16	10	M8	9~11
GD200-037G/045P-4	35	16	25	16	M8	9~11
GD200-045G/055P-4	50	25	35	25	M8	9~11
GD200-055G/075P-4	70	35	50	25	M10	18~23
GD200-075G/090P-4	95	50	70	35	M10	18~23
GD200-090G/110P-4	120	70	95	35	M10	18~23
GD200-110G/132P-4	150	70	120	70	M12	31-40
GD200-132G/160P-4	185	95	150	95	M12	31-40
GD200-160G/185P-4	240	95	185	50	M12	31-40
GD200-185G/200P-4	120*2P	150	95*2P	50	M12	31-40
GD200-200G/220P-4	120*2P	150	95*2P	50	M12	31-40
GD200-220G/250P-4	150*2P	150	95*2P	50	M12	31-40
GD200-250G/280P-4	150*2P	150	120*2P	95	M12	31-40
GD200-280G/315P-4	185*2P	185	120*2P	95	M12	31-40
GD200-315G/350P-4	185*2P	185	120*2P	95	M12	31-40
GD200-350G/400P-4	95*4P	95*2P	150*2P	120	M12	31-40
GD200-400G-4	95*4P	95*2P	150*2P	120	M12	31-40
GD200-500G-4	120*4P	95*2P	95*4P	120	M12	31-40

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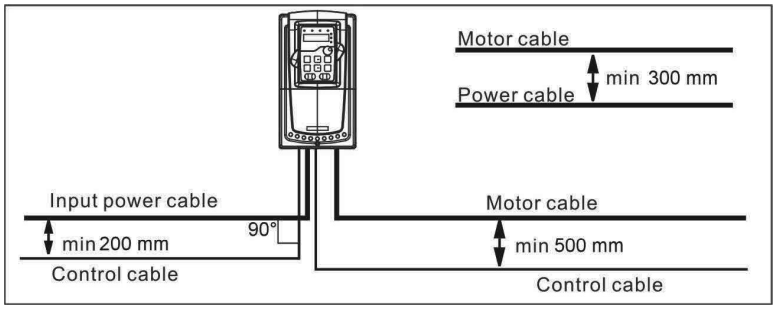
C.4.3 Routing the cables

Route the motor cable away from other cable routes. Motor cables of several drives can be run in parallel installed next to each other. It is recommended that the motor cable, input power cable and control cables are installed on separate trays. Avoid long parallel runs of motor cables with other cables to decrease electromagnetic interference caused by the rapid changes in the drive output voltage.

Where control cables must cross power cables make sure that they are arranged at an angle as near to 90 degrees as possible.

The cable trays must have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential.

A figure of the cable routing is shown below.



C.4.4 Checking the insulation

Check the insulation of the motor and motor cable as follows:

1. Check that the motor cable is connected to the motor and disconnected from the drive output terminals U, V and W.

2. Measure the insulation resistance between each phase conductor and the Protective Earth conductor using a measuring voltage of 500 V DC. For the insulation resistance of other motors, please consult the manufacturer's instructions.

Note: Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.

C.5 Breaker and electromagnetic contactor

It is necessary to add fuse for the avoidance of overload.

It is appropriate to use a breaker (MCCB) which complies with the inverter power in the 3-phase AC power and input power and terminals (R, S and T). The capacity of the inverter should be 1.5-2 times of the rated current.

	✧**Due to the inherent operating principle and construction of circuit breakers, independent of the manufacturer, hot ionized gases may**

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	escape from the breaker enclosure in case of a short-circuit. To ensure safe use, special attention must be paid to the installation and placement of the breakers. Follow the manufacturer's instructions.

Inverter	Breaker (A)	Fuse (A)	Rated current of the reactor (A)
GD200-1R5G-4	10	16	12
GD200-2R2G-4	16	16	12
GD200-004G/5R5P-4	16	25	12
GD200-5R5G/7R5P-4	25	32	25
GD200-7R5G/011P-4	40	40	25
GD200-011G/015P-4	50	50	40
GD200-015G/018P-4	63	63	40
GD200-018G/022P-4	63	80	50
GD200-022G/030P-4	80	100	65
GD200-030G/037P-4	100	125	80
GD200-037G/045P-4	125	160	95
GD200-045G/055P-4	160	160	115
GD200-055G/075P-4	160	200	150
GD200-075G/090P-4	250	250	185
GD200-090G/110P-4	250	315	225
GD200-110G/132P-4	315	315	265
GD200-132G/160P-4	350	400	330
GD200-160G/185P-4	400	500	400
GD200-185G/200P-4	500	630	500
GD200-200G/220P-4	500	630	500
GD200-220G/250P-4	630	630	500
GD200-250G/280P-4	630	800	630
GD200-280G/315P-4	700	800	630
GD200-315G/350P-4	800	1000	780
GD200-350G/400P-4	800	1000	780
GD200-400G-4	1000	1250	780
GD200-500G-4	1200	1250	980

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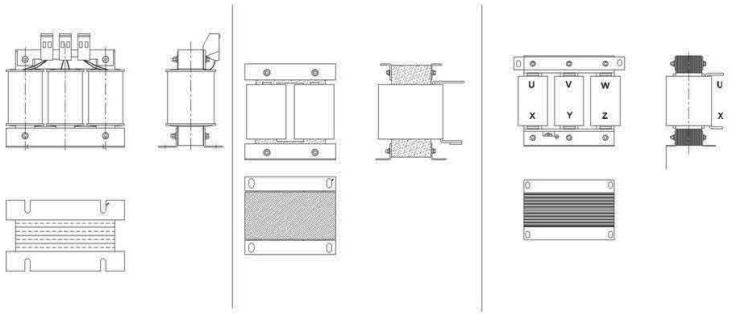
C.6 Reactors

Transient high current in the input power circuit may cause damage to the rectifying components. It is appropriate to use AC reactor in the input side for the avoidance of high-voltage input of the power supply and improvement of the power factors.

If the distance between the inverter and the motor is longer than 50m, frequent overcurrent protection may occur to the inverter because of high leakage current caused by parasitic capacitance effects from the long cables to the ground. In order to avoid the damage of the motor insulation, it is necessary to add reactor compensation. If the distance between the inverter and motor is 50~100m, see the table below for model selection; if it exceeds 100m, consult with INVT technical support.

All the inverters above 37kW (including 37kW) can add external DC reactors for the improvement of power factors and the avoidance of damage from high input current to the rectifying components because of the high-capacity transformer. The device can also cease the damage to the rectifying components which are caused by supply net voltage transients and harmonic waves of the loads.



The power of the inverter	Input reactor	DC reactor	Output reactor
GD200-1R5G-4	ACL2-1R5-4	/	OCL2-1R5-4
GD200-2R2G-4	ACL2-2R2-4	/	OCL2-2R2-4
GD200-004G/5R5P-4	ACL2-004-4	/	OCL2-004-4
GD200-5R5G/7R5P-4	ACL2-5R5-4	/	OCL2-5R5-4
GD200-7R5G/011P-4	ACL2-7R5-4	/	OCL2-7R5-4
GD200-011G/015P-4	ACL2-011-4	/	OCL2-011-4
GD200-015G/018P-4	ACL2-015-4	/	OCL2-015-4
GD200-018G/022P-4	ACL2-018-4	/	OCL2-018-4
GD200-022G/030P-4	ACL2-022-4	/	OCL2-022-4

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The power of the inverter	Input reactor	DC reactor	Output reactor
GD200-030G/037P-4	ACL2-030-4	/	OCL2-030-4
GD200-037G/045P-4	ACL2-037-4	DCL2-037-4	OCL2-037-4
GD200-045G/055P-4	ACL2-045-4	DCL2-045-4	OCL2-045-4
GD200-055G/075P-4	ACL2-055-4	DCL2-055-4	OCL2-055-4
GD200-075G/090P-4	ACL2-075-4	DCL2-075-4	OCL2-075-4
GD200-090G/110P-4	ACL2-090-4	DCL2-090-4	OCL2-090-4
GD200-110G/132P-4	ACL2-110-4	DCL2-110-4	OCL2-110-4
GD200-132G/160P-4	ACL2-132-4	DCL2-132-4	OCL2-132-4
GD200-160G/185P-4	ACL2-160-4	DCL2-160-4	OCL2-160-4
GD200-185G/200P-4	ACL2-200-4	DCL2-200-4	OCL2-200-4
GD200-200G/220P-4	ACL2-200-4	DCL2-200-4	OCL2-200-4
GD200-220G/250P-4	ACL2-250-4	DCL2-280-4	OCL2-250-4
GD200-250G/280P-4	ACL2-250-4	DCL2-280-4	OCL2-250-4
GD200-280G/315P-4	ACL2-280-4	DCL2-280-4	OCL2-280-4
GD200-315G/350P-4	ACL2-315-4	DCL2-315-4	OCL2-315-4
GD200-350G/400P-4	Standard	DCL2-350-4	OCL2-350-4
GD200-400G-4	Standard	DCL2-400-4	OCL2-400-4
GD200-500G-4	Standard	DCL2-500-4	OCL2-500-4

Note:

1. The rated derate voltage of the input reactor is 2%±15%.

2. The power factor of the input side is above 90% after adding DC reactor.

3. The rated derate voltage of the output reactor is 1%±15%.

4. Above options are external, the customer should indicate when purchasing.

C.7 Filters

Goodrive200 series inverters have embedded C3 filters which can be connected by J10.

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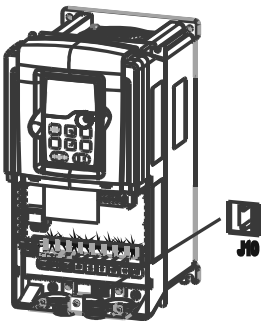

The input interference filter can decrease the interference of the inverter to the surrounding equipments.

Output interference filter can decrease the radio noise cause by the cables between the inverter and the motor and the leakage current of the conducting wires.

Our company configured some filters for the convenient of the users.

C.7.1 Filter type instruction

FLT-P04045L-B
A B C D E F

Character designation	Detailed instruction
A	FLT:inverter filter series
B	Filter type P:power supply filter L:output filter
C	Voltage degree 04:3-phase 380Vac
D	3 bit rated current code “015” means 15A
E	Installation type L: Common type H: High performance type
F	Utilization environment of the filters A: The first environment (IEC61800-3:2004) category C1 (EN 61800-3:2004) B: The first environment (IEC61800-3:2004) category C2 (EN 61800-3:2004) C: The second environment (IEC61800-3:2004) category C3 (EN 61800-3:2004)

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C.7.2 Filters selection table

The inverter	Input filter	Output filter
GD200-1R5G-4	FLT-P04006L-B	FLT-L04006L-B
GD200-2R2G-4		
GD200-004G/5R5P-4	FLT-P04016L-B	FLT-L04016L-B
GD200-5R5G/7R5P-4		
GD200-7R5G/011P-4	FLT-P04032L-B	FLT-L04032L-B
GD200-011G/015P-4		
GD200-015G/018P-4	FLT-P04045L-B	FLT-L04045L-B
GD200-018G/022P-4		
GD200-022G/030P-4	FLT-P04065L-B	FLT-L04065L-B
GD200-030G/037P-4		
GD200-037G/045P-4	FLT-P04100L-B	FLT-L04100L-B
GD200-045G/055P-4		
GD200-055G/075P-4	FLT-P04150L-B	FLT-L04150L-B
GD200-075G/090P-4		
GD200-090G/110P-4	FLT-P04240L-B	FLT-L04240L-B
GD200-110G/132P-4		
GD200-132G/160P-4		
GD200-160G/185P-4	FLT-P04400L-B	FLT-L04400L-B
GD200-185G/200P-4		
GD200-200G/220P-4		
GD200-220G/250P-4	FLT-P04600L-B	FLT-L04600L-B
GD200-250G/280P-4		
GD200-280G/315P-4		
GD200-315G/350P-4	FLT-P04800L-B	FLT-L04800L-B
GD200-350G/400P-4		
GD200-400G-4		
GD200-500G-4	FLT-P041000L-B	FLT-L041000L-B

Note: The input EMI meet the requirement of C2 after adding input filters.

C.8 Braking system

C.8.1 Select the braking components

It is appropriate to use braking resistor or braking unit when the motor brakes sharply or the motor is driven by a high inertia load. The motor will become a generator if its actual rotating

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speed is higher than the corresponding speed of the reference frequency. As a result, the inertial energy of the motor and load return to the inverter to charge the capacitors in the main DC circuit. When the voltage increases to the limit, damage may occur to the inverter. It is necessary to apply braking unit/resistor to avoid this accident happens.

	✧**Only qualified electricians are allowed to design, install, commission and operate on the inverter.** ✧**Follow the instructions in "warning" during working. Physical injury or death or serious property may occur.** ✧**Only qualified electricians are allowed to wire. Damage to the inverter or braking options and part may occur. Read carefully the instructions of braking resistors or units before connecting them with the inverter.** ✧**Do not connect the braking resistor with other terminals except for PB and (-). Do not connect the braking unit with other terminals except for (+) and (-). Damage to the inverter or braking circuit or fire may occur.**
	✧**Connect the braking resistor or braking unit with the inverter according to the diagram. Incorrect wiring may cause damage to the inverter or other devices.**

Goodrive200 series inverters below 30kW (including 30kW) need internal braking units and the inverters above 37kW need external braking unit. Please select the resistance and power of the braking resistors according to actual utilization.

Note:

Select the resistor and power according to the provided data.

The braking torque may increase because of the raising of braking resistor. The below table is calculated at 100% of the braking torque, 10%, 50% and 80%of the braking usage ratio. The user can select according to the actual working.

Refer to the operation instructions of braking units when using external units for right setting of voltage degree. Otherwise normal operation of the inverter may be impacted.

The inverter	Braking unit type	100% of braking torque (Ω)	The consumed power of the braking resistor			Mini Braking Resistor (Ω)
			10% braking	50% braking	80% braking	
GD200-1R5G-4	Internal braking unit	326	0.23	1.1	1.8	170
GD200-2R2G-4		222	0.33	1.7	2.6	130
GD200-004G/5R5P-4		122	0.6	3	4.8	80

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The inverter	Braking unit type	100% of braking torque (Ω)	The consumed power of the braking resistor			Mini Braking Resistor (Ω)
			10% braking	50% braking	80% braking	
GD200-5R5G/7R5P-4		89	0.75	4.1	6.6	60
GD200-7R5G/011P-4		65	1.1	5.6	9	47
GD200-011G/015P-4		44	1.7	8.3	13.2	31
GD200-015G/018P-4		32	2	11	18	23
GD200-018G/022P-4		27	3	14	22	19
GD200-022G/030P-4		22	3	17	26	17
GD200-030G/037P-4		17	5	23	36	17
GD200-037G/045P-4	DBU100H-060-4	13	6	28	44	11.7
GD200-045G/055P-4	DBU100H-110-4	10	7	34	54	6.4
GD200-055G/075P-4		8	8	41	66	
GD200-075G/090P-4		6.5	11	56	90	
GD200-090G/110P-4	DBU100H-160-4	5.4	14	68	108	4.4
GD200-110G/132P-4		4.5	17	83	132	
GD200-132G/160P-4	DBU100H-220-4	3.7	20	99	158	3.2
GD200-160G/185P-4	DBU100H-320-4	3.1	24	120	192	2.2
GD200-185G/200P-4		2.8	28	139	222	
GD200-200G/220P-4		2.5	30	150	240	
GD200-220G/250P-4	DBU100H-400-4	2.2	33	165	264	1.8
GD200-250G/280P-4		2.0	38	188	300	
GD200-280G/315P-4	Two DBU100H-320-4	3.6*2	21*2	105*2	168*2	2.2*2
GD200-315G/350P-4		3.2*2	24*2	118*2	189*2	
GD200-350G/400P-4		2.8*2	27*2	132*2	210*2	
GD200-400G-4		2.4*2	30*2	150*2	240*2	
GD200-500G-4	Two DBU100H-400-4	2*2	38*2	186*2	300*2	1.8*2

✧**Never use a brake resistor with a resistance below the minimum value specified for the particular drive. The drive and the internal chopper are not able to handle the overcurrent caused by the low resistance.**

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	✧**Increase the power of the braking resistor properly in the frequent braking situation (the frequency usage ratio is more than 10%).**

C.8.2 Select the brake resistor cables

Use a shielded cable to the resistor cable.

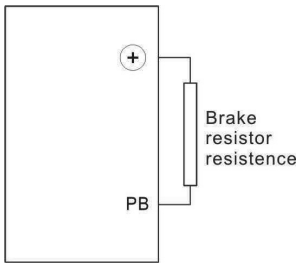
C.8.3 Place the brake resistor

Install all resistors in a place where they will cool.

	✧**The materials near the brake resistor must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. Protect the resistor against contact.**

Installation of the braking resistor:

	✧**The inverters below30kW (including 30kW) only needs external braking resistors.** ✧**PB and (+) are the wiring terminals of the braking resistors.**



Installation of braking units:

	✧**The inverters above 37kW (including 370kW) only needs external braking units.** ✧**(+), (-) are the wiring terminals of the braking units.** ✧**The wiring length between the (+),(-) terminals of the inverter and the (+),(-) terminals of the braking units should be no more than 5m,and the distributing length among BR1 and BR2 and the braking resistor terminals should be no more than 10m.**

Signal installation is as below:

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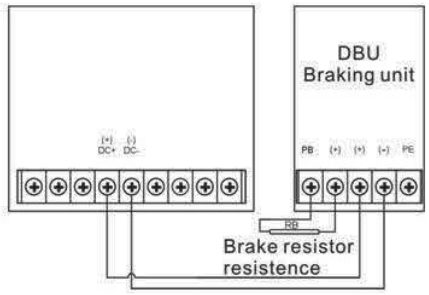
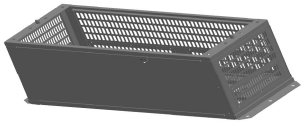
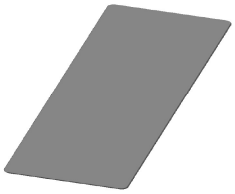


C.9 Other optional parts

No.	Optional part	Instruction	Picture
1	Flange installation bracket	Needed for the flange installation of 1.5~30kW inverters Not needed for the flange installation of 37~200kW inverters	
2	Installation base	Optimal for 220~315kW inverters An input AC/DC reactor and output AC reactor can be put in the base.	
3	Installation bracket	Use the screw or installation bracket to fix the external keypad. Optimal for 1.5~30kW inverters ands standard for 37~500kW inverters	
4	Side cover	Protect the internal circuit in serious environment. Derate when selecting the cover. Please contact INVT for detailed information.	
5	Keypad	Support several languages, parameters copy, high-definition display and the installation dimension is compatible with the LED keypad.	

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Further Information Appendix D

D.1 Product and service inquirie

Address any inquiries about the product to your local INVT offices, quoting the type designation and serial number of the unit in question. A listing of INVT sales, support and service contacts can be found by navigating to www.invt.com.cn.

D.2 Feedback on INVT inverters manuals

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