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DeviceNet Option Card

SOPCG11SDEV

FOR GP10 & VG10

INSTRUCTION MANUAL

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--	Revision 1.03	Corrections.
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02.02.01	Revision 1.12	Changed Produced/Consumed connection paths in Connection Object.
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Related documents

Document	Author
DeviceNet Specification Vol 1 & Vol Rev 2.02	ODVA
GP10 Instruction Manual P/N 027-GP1001 VG10 Instruction Manual P/N 027-VG1001	Saftronics

Preface

The data and illustrations found in this document are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this appendix is subject to change without notice and should not be considered as a commitment by SAFTRONICS, INC.
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The product and technology described in this document is patent pending in the following countries:
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Table of Contents

Applicable inverters

Item	Description		
Inverter type	GP10 and VG10		
Compatible Inverter Model number	The last two digits of the model number should be B1 or later Example: 6KG1123X1B1		
Minimum inverter ROM version number	up to 22 kW(30HP)	EN, Japanese standard, JE, CN, UX and Saftronics version	S08000 and after (It is impossible to use version prior to S08000 inverter.)
	30 kW(40HP) and above	EN, Japanese standard, JN, JE, AN, CN, UX and Saftronics version	H08004 and after (It is impossible to use versions of H00000 to H08003.)

NOTE:

This product can only be used for Inverters with ROM version numbers greater than or equal to the versions shown above.
And in the case of installing this option in the GP10 / VG10 inverter that is a Japanese standard, JN, JE or CN version, please contact Saftronics or its distributors.

Check the ROM number of your Inverter as follows using the inverter keypad.

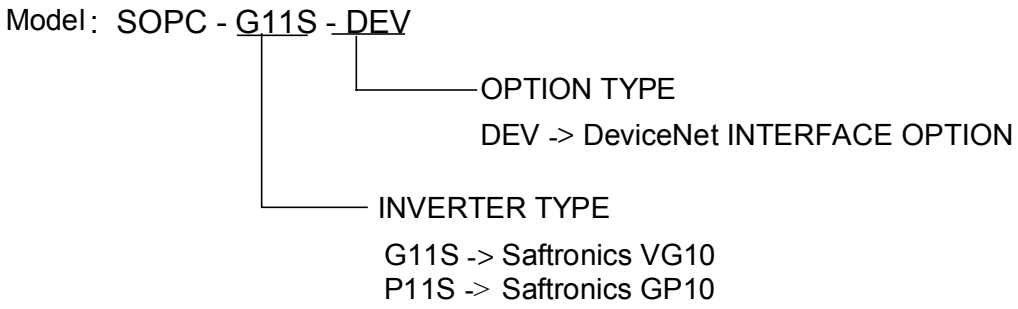
a. Check that the Inverter Operation monitor (Operation mode) screen is displayed.
b. Press the [PRG] key of the Inverter once.
c. Select the "5. MAINTENANC" with the cursor and press the [FUNC/DATA] key.
d. Press the down cursor key to increment the display at the MAINTENANC screen.
Finally, the ROM number is shown in the maintenance information, as indicated by the display "INV=Hxxxxx or Sxxxxx".

The maintenance and inspection items are similar to the Inverter unit, for detail refer to the Inverter Instruction Manual.

Receiving Inspection

Confirm the following items upon a receipt.

1) The model number matches your purchase order?
Check the model number printed on the circuit board.

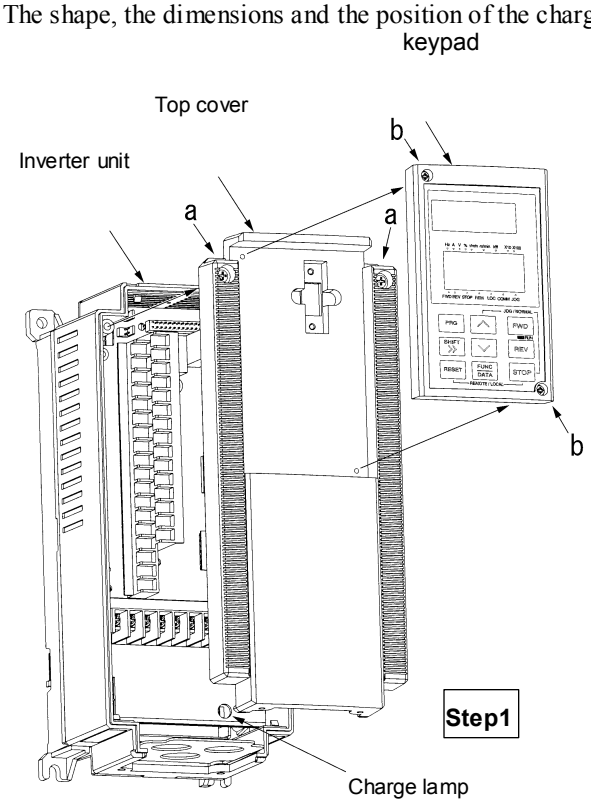


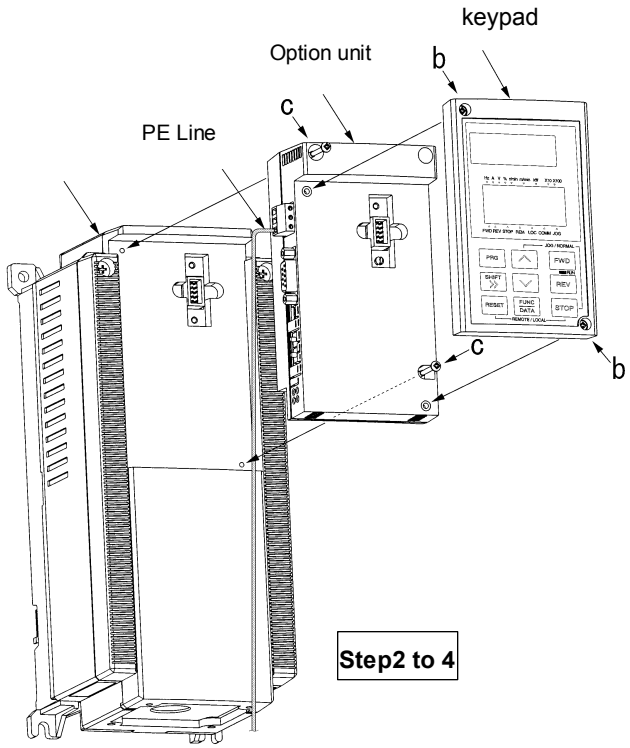
2) Inspection for damage during transportation. Report damage to transportation carrier.

Installation

Installation Method

Please follow the installation procedure described as follows. Please install or detach the option after turning off the input power supply of the inverter and confirming the charge lamp (CHARGE or CRG) is gone out.
The shape, the dimensions and the position of the charge lamp of the inverter are different by each capacity.





Step1

Loosen two screws(M4) at **a** and remove the top cover. Loosen two screws(M3) at **b** and detach the keypad panel. (For the 30kW[40HP] and above inverters, the keypad panel can be detached if the front cover is removed and the screws loosened at **b**.)

Step2

Reassemble the top cover, push-in the option unit and secure it with two screws(M3) at **c.**

Step3 Inverter unit

Secure the keypad panel to the option unit with two screws at **b**.

Step4

Connect the ground cable to the PE terminal of the option unit.

Installation Checklist

Installation Checklist

After installation and wiring, check the following items.

[1] The wiring is correct.
[2] No loose wires or screws remain inside the Inverter.
[3] The screws and terminals are all tight.
[4] There are no loose threads of wires at terminals that may contact other terminals.
[5] The switch positions on the Anybus-S module, JP6 on the conversion-board are suitable for the use purpose. (Do not change the JP4 on the conversion-board!)
[6] Inverter parameters such as H30, o27, o28, o31 to o40, are set correctly. (H30: Link Active/Inactive, o27 and o28: for RAS, o31 to o40: for I/O assembly instances)

1 Fieldbus Introduction

This section provides information about the DeviceNet organisation and network.

1.1 Introduction to DeviceNet

DeviceNet is used for industrial automation, normally for the control of valves, sensors and I/O units and other automation equipment. The DeviceNet communication link is based on a broadcast-oriented, communications protocol, the Controller Area Network (CAN). This protocol has I/O response and high reliability even for demanding applications,e.g., control of brakes.

DeviceNet has an user organisation, the Open DeviceNet Vendor Association (ODVA), that assists members of matters concerning DeviceNet. HMS is a member of ODVA and also represented as a member of the DeviceNet System Architecture SIG.

For further information, please contact ODVA on e-mail: billmoss@ix.netcom.com or at address:
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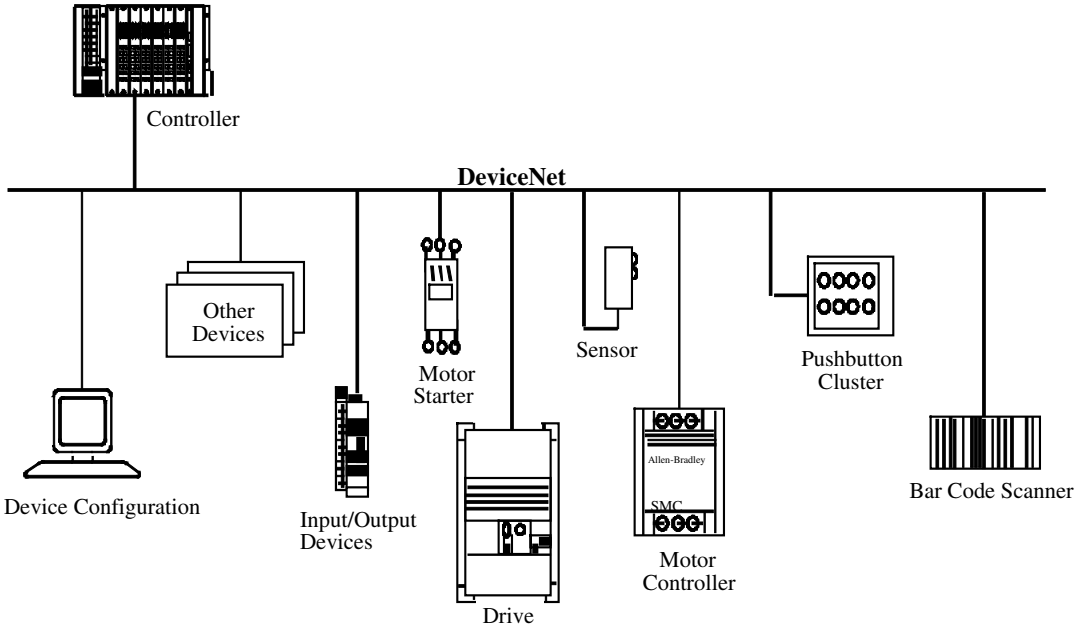
(1) 954 340-5412 or (1) 561 477-7966 Phone
(1) 954 340-5413 or (1) 561 477-6621 Fax

1.2 Network Overview

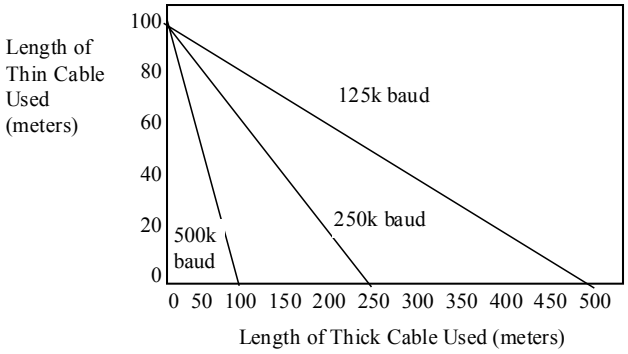
The media for the fieldbus is a shielded copper cable composed of one twisted pair and two cables for the external power supply. The baudrate can be changed between 125k, 250k and 500kbit/s, this can be done in three different ways. First is simply by the DIP switch, second via the fieldbus and third is autobaudrate setting.

Several different DeviceNet Scanners are available on the market, both for PLC-systems and PC computers.



Picture 1: DeviceNet overwiew

1.3 Technical Features for DeviceNet



$L_{thick} + 5 \times L_{thin} = 500$ at 125Kbaud
$L_{thick} + 2.5 \times L_{thin} = 250$ at 250Kbaud
$L_{thick} + L_{thin} = 100$ at 500Kbaud

where L_{thick} is the length of thick cable and Lthin is the length of thin cable.

Picture 2: Maximum cable lenght for DeviceNet network

Summary Technical Features DeviceNet	
• DeviceNet specific cable (twisted pair) • Access to intelligence present in low-level devices -Master/Slave and Peer-to-Peer capabilities • Trunkline-dropline configuration • Support for up to 64 nodes • Node removal without severing the network • Simultaneous support for both network-powered (sensors) and self-powered (actuators) devices • Use of sealed or open-style connectors • Protection from wiring errors • Selectable data rates of 125k baud, 250k baud, and 500k baud. max. Trunk distance 500 meters and Drop lenght 156 meters at 125k baud • Adjustable power configuration to meet individual application needs	• High current capability (up to 16 amps per supply) • Operation with off-the-shelf power supplies • Power taps that allow the connection of several power supplies from multiple vendor that comply with DeviceNet standards • Built-in overload protection • Power available along the bus: both signal and power lines contained in the trunkline • Provisions for the typical request/response oriented network communications • Provisions for the efficient movement of I/O data • Fragmentation for moving larger bodies of information • Duplicate MAC ID detection

Table 1: Technical features for DeviceNet

1.4 Conformance Test

DeviceNet™
CONFORMANCE TESTED

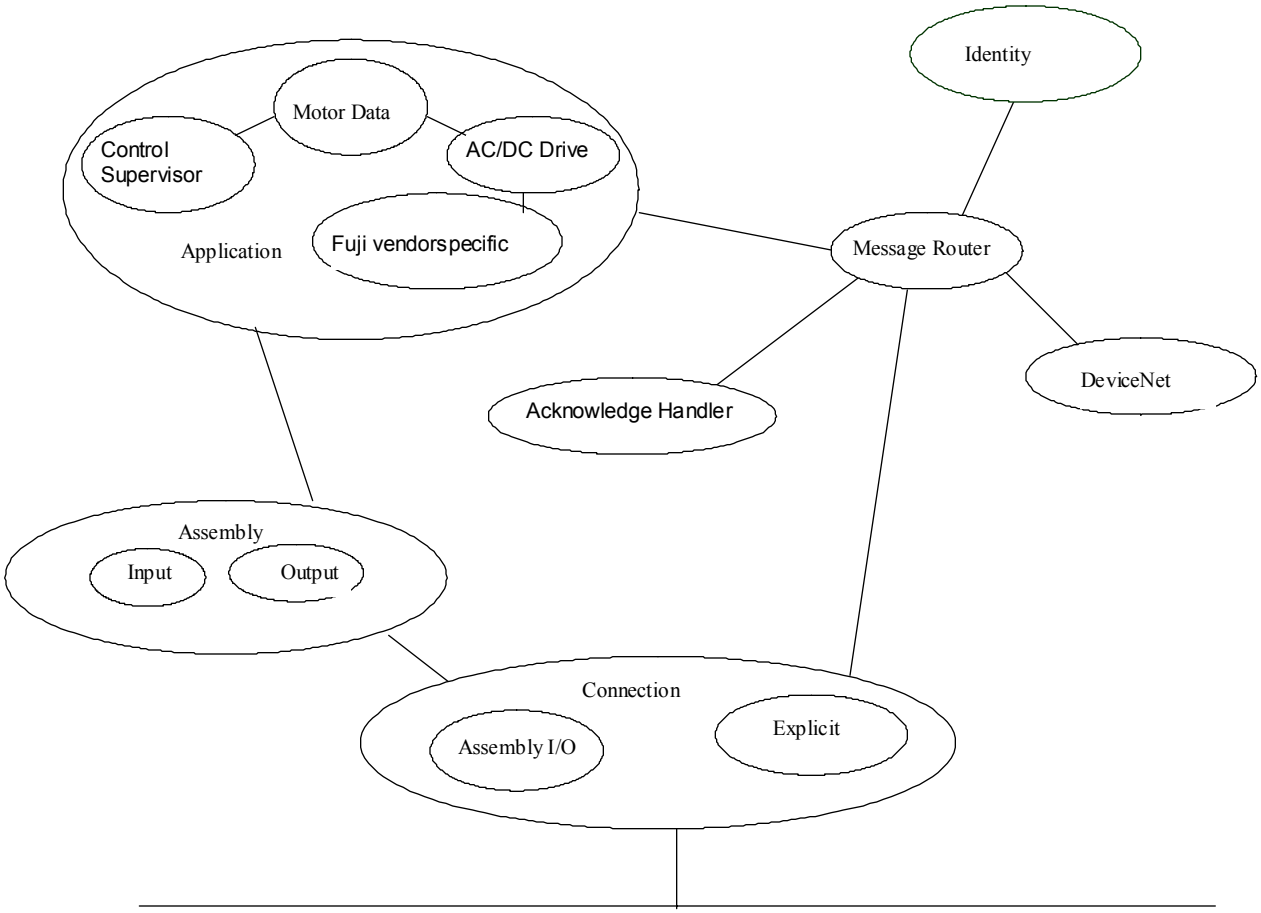
The SOPC-G11S-DEV is tested as a profile AC/DC-drive product at the ODVA conformance test site.

2 Module Overview

This section provides an overview over the AnyBus-S DeviceNet module.
The SOPC-G11S-DEV is implemented according to the ODVA specification for a AC/DC-Drive Profile (profile no 2). It is acting as a ”group two server” on the DeviceNet network.

2.1Profile Object Model

The interface from the fieldbus against the SOPC-G11S-DEV is based on the standard DeviceNet objects, three profile objects and one vendor specific object. Object Model



2.3 Connections

Connections supported:

5 UCMM Explicit Server
1 Master/Slave Explicit Server
1 Master/Slave Polled I/O Server
1 Master/Slave Change of state I/O

3 Installation & Configuration

3.1 Fieldbus Connectors

The table below shows the pin function of the fieldbus connectors.

BUS connector

Pluggable connector	Screw Terminal	Description
1	1	V-
2	2	CAN_L
3	3	SHIELD
4	4	CAN_H
5	5	V+

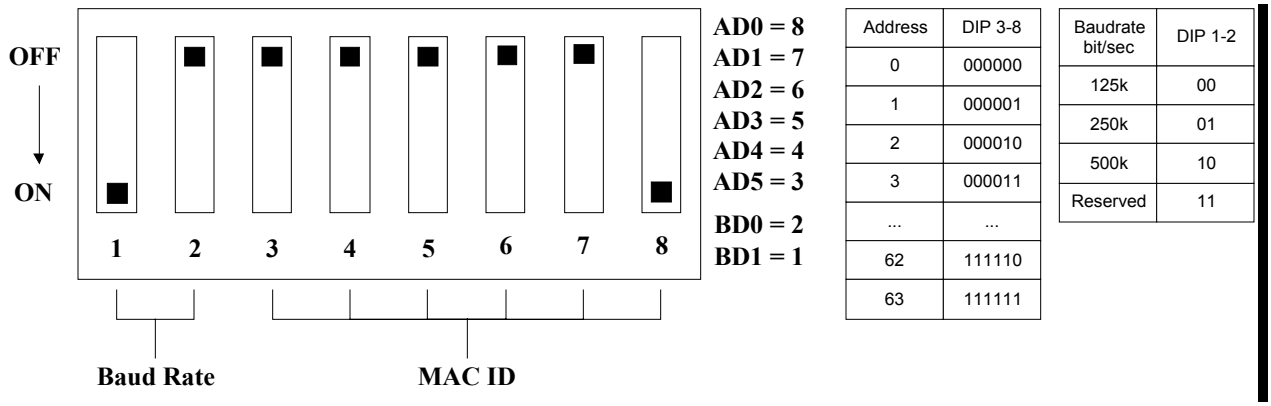
Description of fieldbus connectors

3.2 Configuration

MacId (= Node address) and BaudRate are configured by a DipSwitch at the front of the module. The range for MacID is between 0-63 and BaudRate is between 0 and 2 (0=125kb, 1=250kb, 2=500kb).

3.3 Baudrate

There are three different baudrates for DeviceNet; 125k, 250k, 500kbit/s. Choose one of them by setting the DIP switch before configuring.



Address	DIP 3-8
0	000000
1	000001
2	000010
3	000011
...	...
62	111110
63	111111

Baudrate bit/sec	DIP 1-2
125k	00
250k	01
500k	10
Reserved	11

3.4 Indications

The module is equipped with four LED's mounted at the front and one LED on the board, used for debugging purposes. The functions of the LED's are described in the table and figure below.

1. Reserved
2. Network Status
3. Module Network Status
4. Reserved

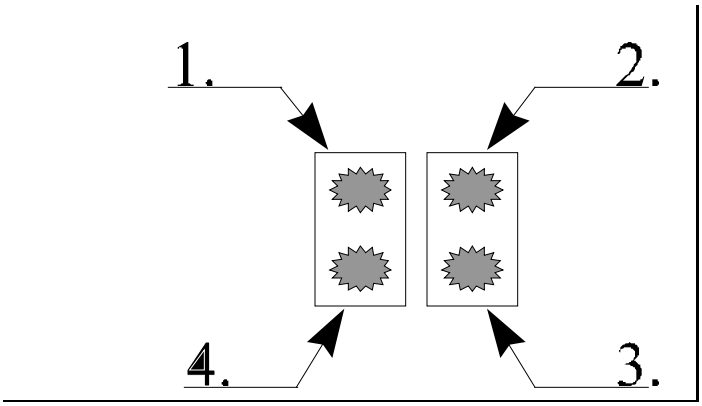


Figure 5. AnyBus-S LED's, angle mounted

There is also one additional Bicolour Watchdog LED on the AnyBus-S module. If LED is not flashing green the option card is not working correctly.

Of the four LED's at the front of the module, two of them are indicating net and module status, and the other two are reserved for future usage.

Module errors are indicated with the Module status LED and NetWork status LED.

LED's	Description
Module _Status, steady off:	No Power
Module _Status, steady red:	Unrecoverable fault
Module _Status, steady green:	Device Operational
Module _Status, flashing red:	Minor fault
NetWork _Status, steady off:	Not Powered/Not on line
NetWork _Status, steady green:	Link OK on line, Connected
NetWork _Status, steady red:	Critical Link failure
NetWork _Status, flashing green:	On line not connected
NetWork _Status, flashing red:	Connection Time Out

3.5 Termination

Termination of the fieldbus requires a terminating resistor at each end of the fieldbus. These resistors should have a value of 121 Ω.

3.6 EDS file

Each device in a DeviceNet network is associated with an EDS file, containing all necessary information about the device. The network configuration tool uses this file during configuration of the network.

3.7 DeviceNet Configuration from inverters keypad

The SOPC-G11S-DEV provides a simple configuration interface through the keypad. The bus configuration parameters use parameters designated for the Analog/Digital I/O option. Since the I/O option cannot be used with the fieldbus option, these parameters can be shared. The keypad supports the most important parameters can be configured this way. For more complex confgurations a configuration tool is needed.

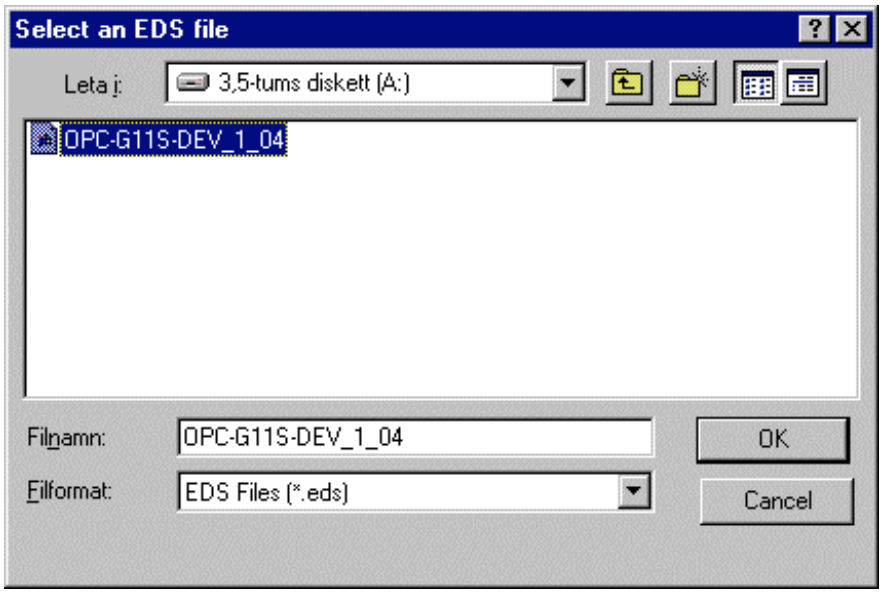
Bus Configuration Parameter	Description	Default Value	Possible values
o27	DN faultmode, defines action when the network is malfunctioning. For further information see Control Supervisor Object.	0	0,1,2,3
o31	Output Assembly Instance, defines what data that will be used for the I/O connection	0 (=21)	20,21,100,102
o32	Input Assembly Instance defines what data that will be used for the I/O connection	0 (=71)	70,71, 101,103
o33	User Defined Output I/O Parameter 1 see assembly object.	0	0-255
o34	User Defined Output I/O Parameter 2 see assembly object.	0	0-255
o35	User Defined Output I/O Parameter 3 see assembly object.	0	0-255
o36	User Defined Output I/O Parameter 4 see assembly object.	0	0-255
o37	User Defined Input I/O Parameter 1 see assembly object.	0	0-255
o38	User Defined Input I/O Parameter 2 see assembly object.	0	0-255
o39	User Defined Input I/O Parameter 3 see assembly object.	0	0-255
o40	User Defined Input I/O Parameter 4 see assembly object.	0	0-255

3.8 DeviceNet Configuration Tool Example

The SOPC-G11S-DEV can be configured with all configuration tools on the market that are DeviceNet compliant. The most common tool is the RSNetworx from Rockwell; this is the one that is used in this example.

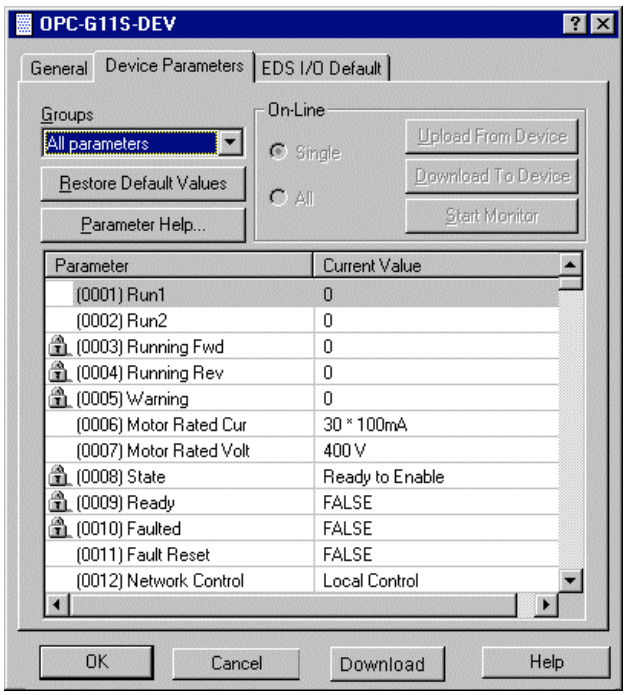
Installation of EDS-file

The first time you start up the configuration tool you must install an EDS file for the SOPC-G11S-DEV. This file contains information about the internal structure and I/O configuration of the device. By choosing Tools ->EDS Wizard in the menu of RSNetWorx the dialog shown below will appear, You must enter the location of the EDS file here. After this RSNetWorx will install all the information from the EDS file into its database.



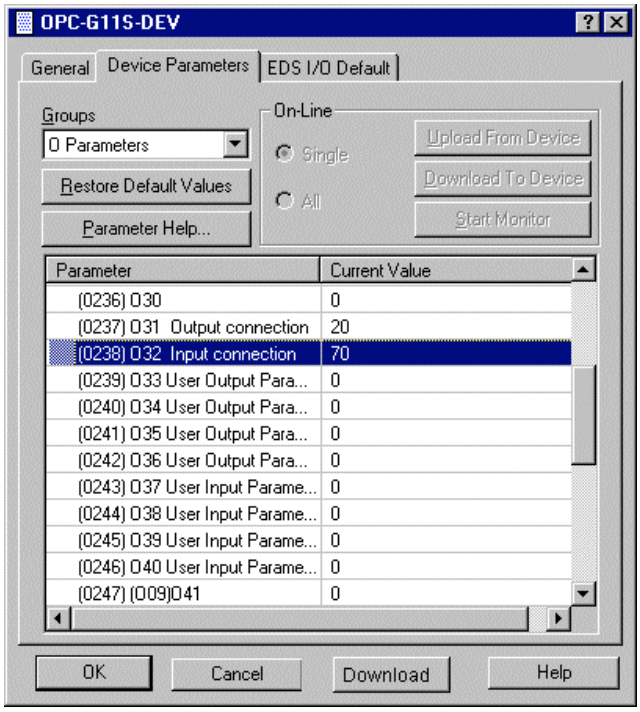
Configuration of Drive parameters

If you make a Network Brose a picture of a motor will appear on the screen. Double-click on the picture and the dialog below will be shown. In this window you can edit and monitor all the drive specific parameters present in the drive. The device parameters appear in the list arranged in numerical order by parameter number. When the lock icon precedes the number, the parameter is read only.



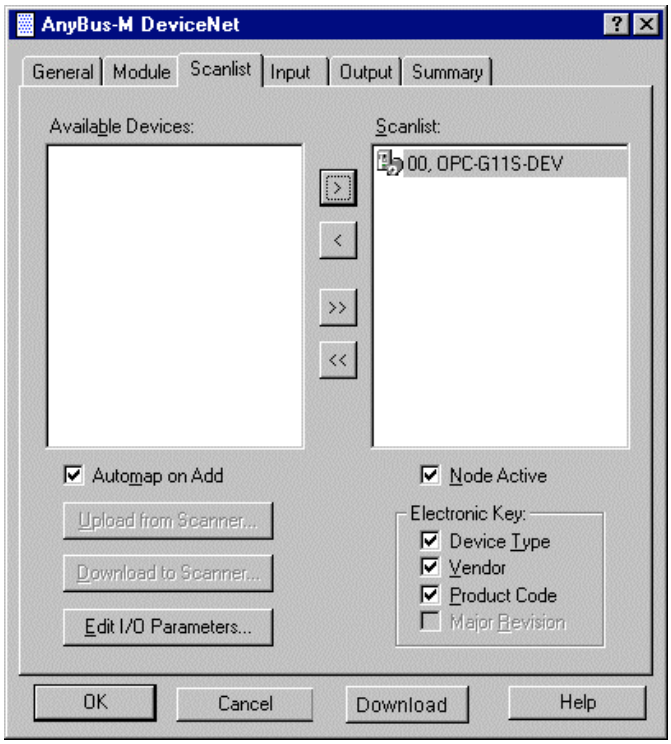
Configuration of I/O assembly Instances

There are two different ways of configuring the I/O assembly instances, one is by the keypad and the other one is explained here. Parameters 233 and 234 in the EDS file are used to choose the actual I/O assemblies. The default value is 21 for the output data and 71 for the input data. If those values are not valid the default values will be used instead. For more information about the I/O assemblies please see the Assembly object section.

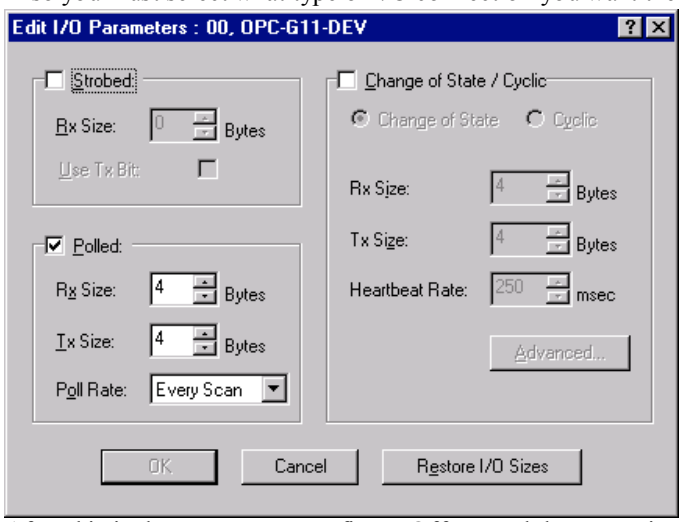


Mapping I/O- data to a Master/Scanner

After the configuration of the SOPC-G11S-DEV itself you will have to configure a connection to a master. This example shows how to configure one specific master. All scanners are configured in different ways but this configuration can be used for all Rockwell scanners and for the AnybBus scanner.
Double-click on the scanners Icon and select “scanlist” and the dialog shown below will appear. Drag the icon from available devices to the scanlist.



Click on the button “Edit I/O Parameters ” and the following dialog will be shown.
Depending on what configuration you have of the I/O assemblies you have to enter the input and output sizes.
Also you must select what type of I/O connection you want the Master to use. The default setting is 4 bytes in/out polled data



After this is done you must configure Offsets and data mapping into the scanners scan list, this is very different for different scanners. Please see the scanners documentation.

4 Fieldbus Specific Object List

The following objects are included in the module:

DeviceNet objects

- Identity object Class 0x01
- Message router Class 0x02
- DeviceNet object Class 0x03
- Assembly object Class 0x04
- Connection object Class 0x05
- Acknowledge Handler object Class 0x2B

Profile specific objects

- AC/DC object Class 0x2A
- Control Super visor object Class 0x29
- Motor data object Class 0x28

Vendor specific objects

- Saftronics parameter Object Class 0x64

4.1 Identity Object, Class 0x01

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get_Attribute_Single	Revision of the Identity Object Class Definition upon which the implementation is based	UINT

Instance Attributes (1)

#	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	Vendor Id	Get	Identification of each vender by number	90, 90, 90	UINT
2	Device Type	Get	Indication of the general type of product	2, 2, 2	UINT
3	Product Code	Get	This is a code assigned by the vendor to describe the device	G11-> 18, E11-> 19, VG7-> 20	UINT
4	Revision	Get	Revision of the item the Identity Object represents	{1,38}, {1,38}, {1,38}	Array of : USINT USINT
5	Status	Get	Summary Status of the Device	0, 0, 255	WORD
6	Serial Number	Get	Serial Number of the device	N/A, N/A, N/A	UDINT
7	Product Name	Get	Human readable identification	" OPC-G11S-DEV ", N/A, N/A	SHORT_STRING
9	Config.Consist. Value	Get	Contents identify configuration of device	N/A, N/A, N/A	UINT

4.2 Message Router Object, Class 0x02

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get_Attribute_Single	Revision of the Message Router Object Class Definition upon which the implementation is based	UINT

4.2 DeviceNet Object, Class 0x03

Class Attributes(0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get_Attribute_Single	Revision of the DeviceNet Object Class Definition upon which the implementation is based	UINT

Instance Attributes (1)

#	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	MAC ID	Get_Attribute_Single	Node Address.	DIPSWITCH, 0, 63	USINT
2	Baud Rate	Get_Attribute_Single	The baud rate of the device	DIPSWITCH, 0, 2	USINT
5	Allocation Information	Get_Attribute_Single	Allocation Choice Master's Mac ID	N/A, N/A, N/A	Struct of: BYTE USINT

4.3 Assembly Object, Class 0x04

Instance		Type	Name
20	Required	Output	Basic Speed Control Output
21	Optional	Output	Extended Speed Control Output
100	Optional	Output	Saftronics Drive Assembly Output
102	Optional	Output	User Defined Assembly
70	Required	Input	Basic Speed Control Input
71	Optional	Input	Extended Speed Control Input
101	Optional	Input	Saftronics Drive Assembly Input
103	Optional	Input	User Defined Assembly

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
20	0						Fault Reset		Run Forward
	1								
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
21	0		NetRef	NetCtrl			Fault Reset	Run Reverse	Run Forward
	1								
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Explanation of 20 and 21 I/O Assembly Data Attribute Components

Name	Class	Instance	Attribute			
			Name	Number	Type	G11 equivalent
Output Data						
RunFwd	Control Superv	1	Run1	3	BOOL	S06 bit 0 = 1
RunRev	Control Superv	1	Run2	4	BOOL	S06 bit 1 = 1
Reset	Control Superv	1	FaultRst	12	BOOL	
NetCtrl	Control Superv	1	NetCtrl	5	BOOL	If NetCtrl = 0 and Net Ref=0 then H30 = 0 If NetCtrl = 0 and Net Ref= 1 then H30 = 1
NetRef	AC/DC Drive	1	NetRef	4	BOOL	If NetCtrl = 1 and Net Ref=0 then H30 = 2 If NetCtrl = 1 and Net Ref= 1 then H30 = 3
Speed Ref	AC/DC Drive	1	SpeedRef	8	INT	Units RPM /$2^{SpeedScale}$

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
70	0						Running Forward		Faulted
	1								
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
71	0	At Reference	Ref From Net	Ctrl From Net	Ready	Running Reverse	Running Forward	Warning	Faulted
	1	Drive State							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Explanation of 70 and 71 I/O Assembly Data Attribute Components

Name	Class	Instance	Attribute			
			Name	Number	Type	G11 equivalent
Faulted	Control Superv	1	Faulted	10	BOOL	M14 bit 11 = 1
Warning	Control Superv	1	Warning	11	BOOL	
Running Forward	Control Superv	1	Running1	7	BOOL	M14 bit 0 = 1
Running Reverse	Control Superv	1	Running2	8	BOOL	M14 bit 1 =1
Ready	Control Superv	1	Ready	9	BOOL	M14 bit 11 = 0, 5 = 1 and 3 = 0
CtlFromNet	Control Superv	1	CtlFromNet	15	BOOL	H30 = 2 or 3 and M14 bit 12 = 1
DriveState	Control Superv	1	DriveState	6	USINT	1=Start/up 2=Not_ready 3=Ready 4=Enabled 5=Stopping 6= FaultStop 7=Faulted
RefFromNet	AC/DC Drive	1	RefFromNet	29	BOOL	H30 = 1 or 3 M14 bit 12 = 1
At Ref	AC/DC Drive	1	At Ref	3	BOOL	Frequency arrival
Speed Act	AC/DC Drive	1	Speed Act	7	INT	Units RPM/$2^{SpeedScale}$ M01 .

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
100	0	X6	X5	X4	X3	X2	X1	REV	FWD
	1	RST	-	-	-	-	X9	X8	X7
	3	Frequency Command (Low Byte) Same as S01							
	4	Frequency Command (High Byte) Same as S01							

Explanation of 100 I/O Assembly Data Attribute Components:

FWD:	Forward rotation command
REV:	Reverse rotation command
X1..X9 :	Multi-function command
RST:	Alarm reset command From 0 to 1 and 1 to 0, minimum interval = 20 mS

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
101	0	VL	TL	NUV	BRK	INT	EXT	REV	FWD
	1	BUSY	ERR	WR	RL	ALM	DEC	ACC	IL
	3	Frequency Output (Low Byte) Same as M06							
	4	Frequency Output (High Byte) Same as M06							

Explanation of 101 I/O Assembly Data Attribute Components:

FWD:	In forward operation	DEC:	In deceleration
REV:	In reverse operation	ALM:	Alarm
EXT:	In DC braking (or in pre-excitation)	RL:	Run command or Frequency command is valid from DeviceNet.
INT:	Inverter Base Off	WR:	Parameter writing right 0: Keypad panel or RS485 1: Link (option)
BRK:	In braking		
NUV:	DC link voltage is establishment (Undervoltage condition at 0)		
TL:	In torque limiting	ERR	Parameter Access error
VL:	In voltage limiting	BUSY	In writing parameter
IL:	In current limiting		
ACC:	In acceleration		

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
102	0	User Defined Output 1 (Low Byte) (Defined by O33)							
	1	User Defined Output 1 (High Byte) (Defined by O33)							
	2	User Defined Output 2 (Low Byte) (Defined by O34)							
	3	User Defined Output 2 (High Byte) (Defined by O34)							
	4	User Defined Output 3 (Low Byte) (Defined by O35)							
	5	User Defined Output 3 (High Byte) (Defined by O35)							
	6	User Defined Output 4 (Low Byte) (Defined by O36)							
	7	User Defined Output 4 (High Byte) (Defined by O36)							

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
103	0	User Defined Input 1 (Low Byte) (Defined by O37)							
	1	User Defined Input 1 (High Byte) (Defined by O37)							
	2	User Defined Input 2 (Low Byte) (Defined by O38)							
	3	User Defined Input 2 (High Byte) (Defined by O38)							
	4	User Defined Input 3 (Low Byte) (Defined by O39)							
	5	User Defined Input 3 (High Byte) (Defined by O39)							
	6	User Defined Input 4 (Low Byte) (Defined by O40)							
	7	User Defined Input 4 (High Byte) (Defined by O40)							

4.4 DeviceNet Connection Object (0x05)

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get_Attribute_Single	Revision of the Connection Object Class Definition upon which the implementation is based	UINT

Explicit Connection Instance (1)

#	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	State	Get	State of the object	1, 0, 5	USINT
2	Instance Type	Get	Indicates either IO or messaging connection	0, 0, 0	USINT
3	Transport Class Trigger	Get	Defines Behavior of the connection	0x83, 0x83, 0x83	BYTE
4	Produced Cnxn Id	Get	Placed in CAN Identifier Field when the Connection Transmits	N/A, N/A, N/A	UINT
5	Consumed Cnxn Id	Get	CAN Identifier Field value that denotes message to be received	N/A, N/A, N/A	UINT
6	Inital Comm Characteristics	Get	Defines the Message Group(s) across which productions and consumptions associated with this	N/A, N/A, N/A	BYTE
7	Produced Connection Size	Get	Maximum number of bytes transmitted across this Connection	256, 256, 256	UINT
8	Consumed Connection Size	Get	Maximum number of bytes received across this Connection	256, 256, 256	UINT
9	Expected Packet Rate	Get, Set	Defines timing associated with this Connection	N/A, N/A, N/A	UINT
12	Watchdog Timeout Action	Get, Set	Defines how to handle Inactivity/Watchdog timeouts	N/A, N/A, N/A	USINT
13	Produced Connection Path Length	Get	Number of bytes in the produced_connection_path length attribute	256, 256, 256	UINT
14	Produced Connection Path	Get	Application Obj. producing data on this connection	NULL, NULL, NULL	ARRAY OF: USINT
15	Consumed Connection Path Length	Get	Number of bytes in the consumed_connection_path length attribute	256, 256, 256.	UINT
16	Consumed Connection Path	Get	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object	NULL, NULL, NULL	ARRAY OF: 01 UINT
17	Production Inhibit Time	Get	Defines minimum time between new data production	0,0,0	UINT

Polled I/O Connection Instance (2)

#	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	State	Get	State of the object	1,0, 4	USINT
2	Instance Type	Get	Indicates either IO or messaging connection	0, 0, 1	USINT
3	Transport Class Trigger	Get	Defines Behavior of the connection	N/A, N/A, N/A	BYTE
4	Produced Cnxn Id	Get	Placed in CAN Identifier Field when the Connection Transmits	N/A, N/A, N/A	UINT
5	Consumed Cnxn Id	Get	CAN Identifier Field value that denotes message to be received	N/A, N/A, N/A	UINT
6	Inital Comm Characteristics	Get	Defines the Message Group(s) across which productions and consumptions associated with this	N/A, N/A, N/A	BYTE
7	Produced Connection Size	Get	Maximum number of bytes transmitted across this Connection	I/O in length, 0, I/O in length	UINT
8	Consumed Connection Size	Get	Maximum number of bytes received across this Connection	I/O out length, 0, I/O out length	UINT
9	Expected Packet Rate	Get, Set	Defines timing associated with this Connection	N/A, N/A, N/A	UINT
12	Watchdog Timeout Action	Get	Defines how to handle Inactivity/Watchdog timeouts	N/A, N/A, N/A	USINT
13	Produced Connection Path Length	Get	Number of bytes in the produced_connection_path length attribute	3, 3, 3	UINT
14	Produced Connection Path	Get	Application Obj. producing data on this connection	0x20 0x04 0x24 0x47 0x30 0x03, N/A, N/A	ARRAY OF: USINT
15	Consumed Connection Path Length	Get	Number of bytes in the consumed_connection_path length attribute	3, 3, 3	UINT
16	Consumed Connection Path	Get	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object	0x20 0x04 0x24 0x15 0x30 0x03, N/A, N/A	ARRAY OF: UINT
17	Production Inhibit Time	Get	Defines minimum time between new data production	0, 3FFF, N/A	UINT

Change of state/Cyclic (4) (Acknowledged)

#	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	State	Get	State of the object	1, N/A, N/A	USINT
2	Instance Type	Get	Indicates either IO or messaging connection	1, 0, 1	USINT
3	Transport Class Trigger	Get	Defines Behavior of the connection	N/A, N/A, N/A	BYTE
4	Produced Cnxn Id	Get	Placed in CAN Identifier Field when the Connection Transmits	N/A, N/A, N/A	UINT
5	Consumed Cnxn Id	Get	CAN Identifier Field value that denotes message to be received	N/A, N/A, N/A	UINT
6	Inital Comm Characteristics	Get	Defines the Message Group(s) across which productions and consumptions associated with this	N/A, N/A, N/A	BYTE
7	Produced Connection Size	Get	Maximum number of bytes transmitted across this Connection	0, 0, N/A	UINT
8	Consumed Connection Size	Get	Maximum number of bytes received across this Connection	0, 0, N/A	UINT
9	Expected Packet Rate	Get, Set	Defines timing associated with this Connection	0, 0, 0xffff	UINT
12	Watchdog Timeout Action	Get	Defines how to handle Inactivity/Watchdog timeouts	N/A, N/A, N/A	USINT
13	Produced Connection Path Length	Get	Number of bytes in the produced_connection_path length attribute	3, 0, 3	UINT
14	Produced Connection Path	Get	Application Obj. producing data on this connection	0x20 0x04 0x24 0x47 0x30 0x03, N/A, N/A	ARRAY OF: USINT
15	Consumed Connection Path Length	Get	Number of bytes in the consumed_connection_path length attribute	5, 0, 5	UINT
16	Consumed Connection Path	Get	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object	0x20 0x2B 0x25 0x01 0x00, N/A, N/A	ARRAY OF: UINT
17	Production Inhibit Time	Get, Set	Defines minimum time between new data production	0, 3FFF, N/A	UINT

4.5 Acknowledge Handler Object (0x2B)

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get_Attribute_Single	Revision of the Acknowledge Handler Object Class Definition upon which the implementation is based	UINT

Instance Attributes (1)

#	Attribute Name	Services	Description	Semantics	Default, Minimum, Maximum	Data Type
1	Acknowledge Timer	Get, Set	Time to wait for acknowledge before resending	Range 4-65535 ms(0 invalid) default=16 In steps of 4 ms.	16,4,65535	UINT
2	Retry Limit	Get, Set	Number of Ack Timeouts to wait before informing the producing application of a Retry-Limit_Reached event.	Range 0-255 default.	1,0,255	USINT
3	COS Producing Connection Instance	Get	Connection Instance which contains the path of the producing I/O application object a which will be notified of Ack Handlere events.	Connection instance Id	N/A	UINT

4.6 Motor Data Object (0x28)

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get	Revision of the DeviceNet Object Class Definition upon which the implementation is based	UINT

Instance Attributes (1)

#	Attribute Name	Services	Description	Correspondence to Saftronics Parameter map	Default, Minimum, Maximum	Data Type
3	Motor Type	Get		7 = Squirrel Cage Induction Motor.Only .	7,7,7	USINT
6	Rated Current	Get, Set	Rated Stator Current from motor name plate		16,1,65535	UINT
7	Rated Voltage	Get, Set	Rated Base Voltage from motor name plate		1,0,480	UINT

4.7 Control Supervisor Object (0x29)

Class Attributes (0)

	Attribute Name	Services	Description	Data Type
1	Revision	Get	Revision of the DeviceNet Object Class Definition upon which the implementation is based	UINT

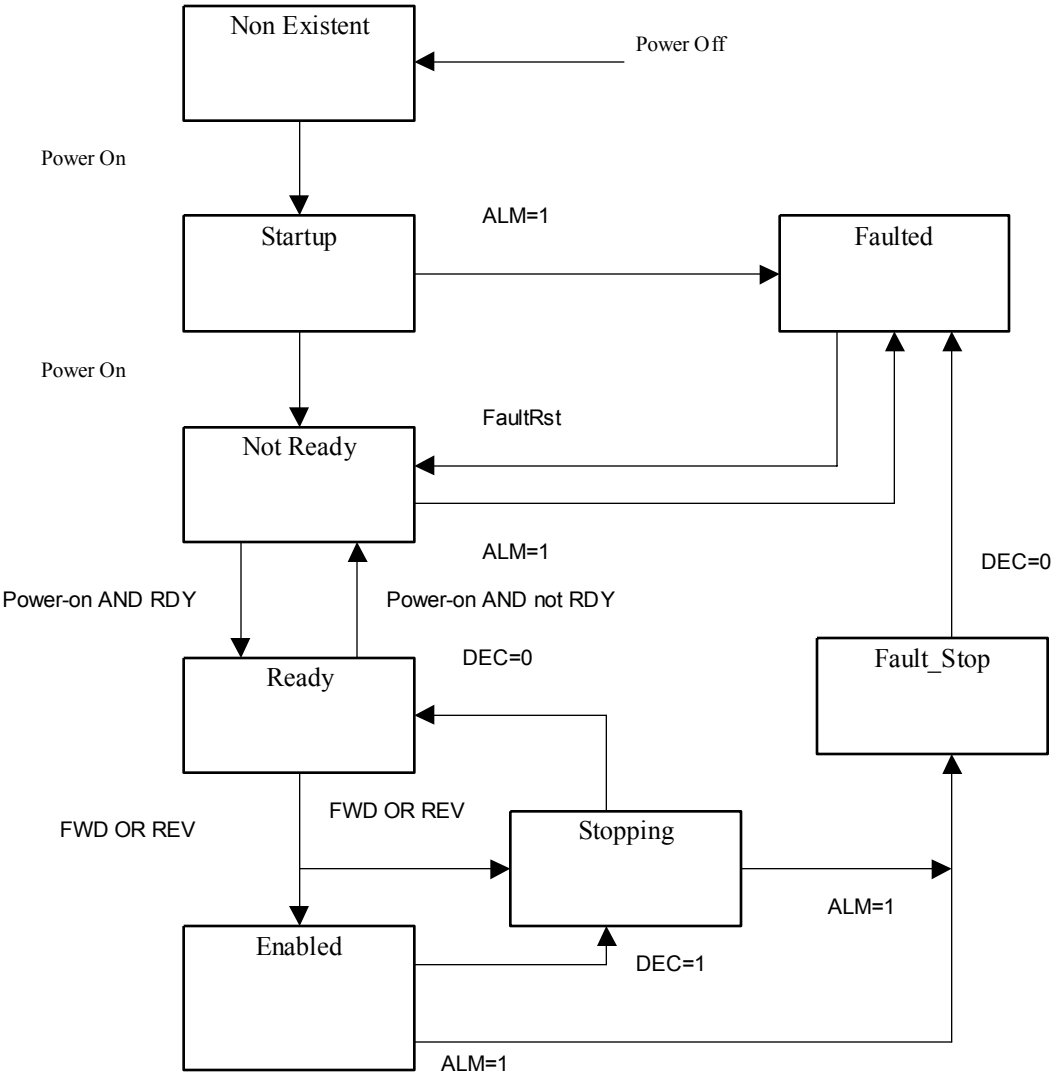
Instance Attributes (1)

#	Attribute Name	Services	Correspondence to Saftronics Parameter map		Data Type
3	Run 1	Get, Set	Bit 0 = 1 of S06		BOOL
4	Run 2	Get, Set	Bit 1 = 1 of S06		BOOL
5	Net Control	Get, Set	NetCtrl = 1	If NetRef = 1 Then H30 = 3 If Net Ref = 0 Then H30 = 2	BOOL
			NetCtrl =0	If NetRef = 1 Then H30 = 1 If Net Ref = 0 Then H30 =0	
6	State	Get	1=Start/up 2=Not_ready 3=Ready 4=Enabled 5=Stopping 6= FaultStop 7=Faulted		UINT
7	Running 1	Get	Bit0=1 of M14		BOOL
8	Running2	Get	Bit1=1 of M14		BOOL
9	Ready	Get	1=Ready or Enabled or Stopping 0=Other State		BOOL
10	Faulted	Get	Bit11 =1 of M14		BOOL
11	Warning	Get			BOOL
12	FaultRst	Get, Set	Bit 15 = 0 to 1 and 1 to 0 of S06		BOOL
15	CtlFromNet	Get	When H30 = 2 or 3, and bit 12 of M14 , CtlFromNet=1.Otherwise CtlFromNet=0.		BOOL
16	DNFaultMode	Get, Set	0 is equivalent to o27 = 0, 1 is equivalent to o27 = 3, 2 is equivalent to o27 = 2		USINT

Run/Stop Event Matrix

RunFwd	RunRev	Trigger Event	Run Type
0	0	Stop	N/A
0->1	0	Run	RunFwd
0	0->1	Run	RunRev
0->1	0->1	No Action	N/A
1	1	No Action	N/A
1->0	1	Run	RunRev
1	1->0	Run	RunFwd

State transition diagram



4.8 AC/DC-Drive Object (0x2A)

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get	Revision of the DeviceNet Object Class Definition upon which the implementation is based	UINT

Instance Attributes (1)

#	Attribute Name	Services	Correspondence to Saftronics Parameter map		Data Type
3	At Reference	Get	Frequency arrival		BOOL
4	NetRef	Get	When H30 = 1 or 3, and bit 12 of M14=1	NetRef=1	BOOL
			Otherwise	NetRef=0	
		Set	NetRef = 1	If NetCtrl = 1 Then H30 = 3 If NetCtrl = 0 Then H30 = 1	
			NetRef = 0	If NetCtrl = 1 Then H30 = 2 If NetCtrl = 0 Then H30 = 0	
6	Drive mode	Get	0= Vendorspecific mode;		USINT
7	Speed Actual	Get	M06 Units RPM/$2^{SpeedScale}$		UINT
8	SpeedRef	Get, Set	S01 Units RPM/$2^{SpeedScale}$		UINT
17	Output Volatage	Get	M12 Units V/$2^{VoltageScale}$		UINT
18	AccelTime	Get, Set	S08 Units msec/$2^{TimeScale}$		UINT
19	DecelTime	Get, Set	S09 Units msec/$2^{TimeScale}$		UINT
20	LowSpdLimit	Get, Set	F16 Units RPM/$2^{SpeedScale}$		UINT
21	HighSpeedLimit	Get, Set	Maximum output frequency Units RPM/$2^{SpeedScale}$		UINT
22	Speed Scale (Note2)	Get, Set	Internal in AnyBus		USINT
23	Current Scale (Note2)	Get, Set	Internal in AnyBus		USINT
27	Volatge Scale (Note2)	Get, Set	Internal in AnyBus		USINT
28	Time Scale (Note2)	Get, Set	Internal in AnyBus		USINT
29	RefFromNet	Get	Reflects NetRef		BOOL

Note1: Since the resolution of AcelTime and DecelTime are 1mS and the data type is 16bit unsigned. Please use the Time scale for other resolutions if necessary.
Note2: If the devicenetmodule returns a NACK (Invalid parameter) when trying to write to the scaleparameters (Attributes 22,23,27 and 28), a powercycle of the module must be done (Turn the power off and on), to be able to store the scaleparametervalues again.

4.9 Saftronics VendorSpecific Object (0x64)

Class Attributes (0)

#	Attribute Name	Services	Description	Data Type
1	Revision	Get_Attribute_Single	Revision of the VendorSpecific Object Class Definition upon which the implementation is based	UINT

Instance Attributes (1)

#	Services	Attribute Name	Correspondence to Saftronics Parameter map	Data Type
0	Get_Attribute_Single	Attribute 1	Revision of the class First revision is 1.1 Size: 1 word.	USINT,USINT
1	Get, Set	Attribute 1	Parameter 1 in the Saftronics parameter list Size: 1 word	UINT
		Attribute 2	Parameter 2 in the VG10/GP10 parameter list Size: 1 word	UINT
		Attribute n	Parameter n in the VG10/GP10 parameter list Size: 1 word	UINT
		Attribute 255	Parameter 255 in the VG10/GP10 parameter list Size: 1 word	UINT

Note:
This table is only providing the method of reading and writing the parameters, the format and meaning is explained in detail in the next section.

Parameters specific for communication

To operate the inverters or to monitor the state via communication, the following parameters are available for communication in addition to the configuration functions of the inverters. These parameters are a common data format applicable to inverter types on and after GP10 / VG10 series, so that it is possible to access different inverter types by the same program on the host side.

Command data

Code	Name	Unit	Variable range	Min. unit	Read/write
S01	Setting frequency (p.u.)	-	-20000–20000 (Maximum frequency at ±20000)	1	R
S05	Setting frequency	Hz	0.00–400.00 (P11S: 0.00–120.00)	0.01	R

R: Reading
W: Writing

Note:

1) The data writing exceeding the setting range is possible, but the actual action will be restricted within the inverter.
2) When the command data is read, it is not the command data of actual action but the command data communicated before (the final command data can be obtained by reading of the monitoring data described later).

Operation command data

Code	Name	Unit	Variable range	Min. unit	Read/write
S06	Operation command	-	Refer to the data format [11]	-	R/W
S07	Universal Do	-	Refer to the data format [12]	-	R/W
S12	Universal Ao	-	-20000–20000 (100% output at ±20000)	1	R/W

Note:

1) Since X1–X9 are multi-function inputs, it is necessary to set the functions with E01–E09.
2) The alarm reset is executed, when RST signal changes from ON to OFF even there are no alarming factors.
3) Universal Do is a function utilizing inverter's Do via transmission.
   (In detail, refer to the detail descriptions E20–E24 in "Function Explanation" in the instruction manual of inverter).
4) The data writing exceeding the setting range is possible, but the actual action will be restricted within the inverter.

5) When the operation commands are instructed through the communication, the relation to the inverter terminal commands becomes as follows.

Function				Command	
Classification		Symbol	Name	Transmission	Terminal block
Operation command		FWD/REV	FWD/REV command	Valid	Invalid
Multi-function command	0–3	SS1, 2, 4, 8	Multistep freq. selection		
	4, 5	RT1, RT2	ACC/DEC time selection		
	6	HLD	3-wire operation stop command	Invalid	
	7	BX	Coast-to-stop command	Valid	
	8	RST	Alarm reset		
	9	THR	Trip command (External fault)	Invalid	Valid
	10	JOG	Jogging operation	Invalid	
	11	Hz2/Hz1	Freq. set. 2 / Freq. set. 1	Valid	Invalid
	12	M2/M1	Motor 2 / Motor 1		
	13	DCBRK	DC brake command		
	14	TL2/TL1	Torque limiter 2 / Torque limiter 1		
	15, 16	SW50, SW60	Switching operation between line and inverter (50, 60Hz)		
	17, 18	UP, DOWN	UP, DOWN command	Invalid	Valid
	19	WE-KP	Write enable for KEYPAD	Valid	Invalid
	20	Hz/PID	PID control cancel		
	21	IVS	Inverse mode changeover (terminals 12 and C1)		
	22	IL	Interlock signal for 52-2	Invalid	Valid
	23	Hz/TRQ	TRQ control cancel	Valid	Invalid
	24	LE	Link enable (Bus, RS485)	Invalid	Valid
	25	U-DI	Universal DI		
	26	STM	Pick up start mode	Valid	
	27	PG/Hz	SY-PG enable	Valid	Invalid
	28	SYC	Synchronization command		
	29	ZERO	Zero speed command		
	30	STOP1	Forced stop command	Invalid	Valid
	31	STOP2	Forced stop command with Deceleration time 4		
	32	EXITE	Pre-exciting command	Valid	

Function data

Code	Name	Unit	Variable range	Min. unit	Read/Write
S08	Acceleration time F07	s	0.1–3600.0	0.1	R/W
S09	Deceleration time F08	s	0.1–3600.0	0.1	R/W
S10	Torque limit level 1 (Driving) F40	%	20.00–200.00 (P11S : 20.00–150.00), 999	1.00	R/W
S11	Torque limit level 2 (Braking) F41	%	0.00, 20.00–200.00 (P11S : 20.00–150.00), 999	1.00	R/W

Note:

1) The writing to out of the range is treated as out of range error.
2) The acceleration and deceleration time S08 and S09 are assigned to "F07: Acceleration time,P" and "F08: Deceleration time 1" respectively.
3) The torque limit level 1 and 2 of S10 and S11 are assigned to "F40: Torque limit 1 (Driving)" and "F41: Torque limit 1 (Braking)" respectively

Monitoring data

Code	Description	Unit	Range	Min. unit	Read/Write
M01	Setting frequency (Final data)	-	-20000–20000 (Maximum frequency at ±20000)	1	R
M05	Setting frequency (Final data)	Hz	0–400.00 (P11S: 0.00–120.00)	0.01	R
M06	Output frequency 1	-	-20000–20000 (Maximum frequency at ±20000)	1	R
M07	Torque calculation value	%	-200.00–200.00	0.01	R
M08	Torque current	%	-200.00–200.00	0.01	R
M09	Output frequency 1	Hz	0.00–400.00 (P11S□0.00–120.00)	0.01	R
M10	Input power	%	0.00–200.00	0.01	R
M11	Output current	%	0.00–200.00 (Inverter rating at 100.00)	0.01	R
M12	Output voltage	V	0.0–600.0	1.0	R
M13	Operation command (Final data)	-	Refer to the data format [11]	-	R
M14	Operating state	-	Refer to the data format [13]	-	R
M15	Y1-Y5 output terminal data	-	Refer to the data format [12]	-	R
M16	Fault memory 0	-	Refer to the Alarm code table below	-	R
M17	Fault memory (1st prior)	-			
M18	Fault memory (2nd prior)	-			
M19	Fault memory (3rd prior)	-			
M20	Operating time	h	0–65535	1	R
M21	DC link circuit voltage	V	0–1000	1	R
M23	Type code	-	Refer to the data format [14]	-	R
M24	Capacity code	-	Refer to the data format [9]	-	R
M25	ROM version	-	0–64999	1	R
M26	Transmission error code (RS 485)	-	Refer to the Alarm code table below	-	R
M27	Setting frequency at alarming (Final data)	-	-20000–20000 (Maximum frequency at 20000)	1	R
M31	Setting Frequency at alarming (Final data)	Hz	0–400.00 (P11S: 0.00–120.00)	0.01	R
M32	Output frequency at alarming	-	-20000–20000 (Maximum frequency at ±20000)	1	R
M33	Torque calculation value at alarming	%	-200.00–200.00	0.01	R
M34	Torque current at alarming	%	-200.00–200.00	0.01	R
M35	Output frequency 1 at alarming	Hz	-400.00–400.00 (P11S: -120.00–120.00)	0.01	R
M36	Input power at alarming	%	0.00–200.00	0.01	R
M37	Output current at alarming	%	0.00–200.00 (Inverter rating at 100.00)	0.01	R

M38	Output voltage at alarming	V	0.0–600.0	1.0	R
M39	Operation command at alarming	-	Refer to the data format [11]	-	R
M40	Operating state at alarming	-	Refer to the data format [13]	-	R
M41	Y1-Y5 output terminal data at alarming	-	Refer to the data format [12]	-	R
M42	Operation time at alarming	H	0–65535	1	R
M43	DC link circuit voltage at alarming	V	0–1000	1	R
M44	Inverter internal air temp. at alarming	°C	0–120	1	R
M45	Cooling fin temp. at alarming	°C	0–120	1	R
M46	Life of main circuit capacitor	%	0.0–100.0	0.1	R
M47	Life of printed circuit board capacitor	H	0–65535	1	R
M48	Life of cooling fan	H	0–65535	1	R

Note :

1) The output frequency 1 is before slip compensation.
2) The output frequency 1 with speed regulator (using option OPC-G11S-PG) is treated as the synchronous frequency.
3) Alarm code

Code	Description		Code	Description	
0	No alarm	---	28	PG error	Pg
1	Overcurrent (During acceleration)	OC1	31	Memory error	Er1
2	Overcurrent (During deceleration)	OC2	32	KEYPAD panel communication error	Er2
3	Overcurrent (While running at constant speed)	OC3	33	CPU error	Er3
5	Ground fault	EF	34	Option communication error	Er4
6	Overvoltage (During acceleration)	OU1	35	Option error	Er5
7	Overvoltage (During deceleration)	OU2	36	Operating proc. error	Er6
8	Overvoltage (While running at constant speed)	OU3	37	Output phase loss error	Er7
10	Undervoltage	LU	38	RS485 communication error	Er8
11	Input phase lose	Lin	71	Check sum error	
14	Fuse blown	FUS	72	Parity error	
16	Output wiring error	Er7	73	Other errors	
17	Overheat of heat sink in inverter	OH1	74	Format error	
18	External alarm input	OH2	75	Command error	
19	Overheat of unit internal temp.	OH3	76	Priority of link	
22	Overheat of DB resistance	dbH	77	No writing right for error	
23	Electronic thermal overload relay (Motor 1)	OL1	78	Function code error	
24	Electronic thermal overload relay (Motor 2)	OL2	79	Forbidden writing error	
25	Electronic thermal overload relay (Inverter)	OLU	80	Data error	
27	Overspeed	OS	81	Error during writing	

Parameter data format

The data formats for various parameter data of the inverters are defined here. The data shall be prepared according to the following data format specifications. The instruction manual of inverter shall be referred to for the range and unit of data. The communication number is used to access inverter parameters through the fieldbus option and to configure process data exchange.

List of parameter data format

Code	Communication No. decimal (Hex.)	Name	Data Format	Code	Communication No. decimal (Hex.)	Name	Data Format
-	0	-	-	M31	45(2D)	Setting frequency at alarming (Final data)	[5]
S01	1(1)	Setting frequency (p.u.)	[2]				
-	2(2)	-	-	M32	46(2E)	Output frequency at alarming	[2]
-	3(3)	-	-	M33	47(2F)	Torque calculation value at alarming	[6]
-	4(4)	-	-	M34	48(30)	Torque current at alarming	[6]
S05	5(5)	Setting frequency	[5]	M35	49(31)	Output frequency 1 at alarming	[5]
S06	6(6)	Operation command	[11]	M36	50(32)	Input power at alarming	[5]
S07	7(7)	Universal Do	[12]	M37	51(33)	Output current at alarming	[5]
S08	8(8)	Acceleration time	[3]	M38	52(34)	Output voltage at alarming	[3]
S09	9(9)	Deceleration time	[3]	M39	53(35)	Operation command at alarming	[11]
S10	10(A)	Torque limit level 1	[5] *1	M40	54(36)	Operating state at alarming	[13]
S11	11(B)	Torque limit level 1	[5] *1	M41	55(37)	Y1-Y5 output terminal data at alarming	[12]
S12	12(C)	Universal Ao	[2]				
-	13(D)	-	-	M42	56(38)	Operating time at alarming	[1]
-	14(E)	-	-	M43	57(39)	DC link circuit voltage at alarming	[1]
M01	15(F)	Setting frequency (Final data)	[2]	M44	58(3A)	Inverter internal air temp. at alarming	[1]
-	16(10)	-	-				
-	17(11)	-	-	M45	59(3B)	Cooling fin temp. at alarming	[1]
-	18(12)	-	-	M46	60(3C)	Life of main circuit capacitor	[3]
M05	19(13)	Setting frequency (Final data)	[5]	M47	61(3D)	Life of printed circuit board capacitor	[1]
M06	20(14)	Output frequency 1	[2]	M48	62(3E)	Life of cooling fan	[1]
M07	21(15)	Torque calculation value	[6]	-	63(3F)	-	-
M08	22(16)	Torque current	[6]	-	64(40)	-	-
M09	23(17)	Output frequency 1	[5]	-	65(41)	-	-
M10	24(18)	Input power	[5]	-	66(42)	-	-
M11	25(19)	Output current	[5]	-	67(43)	-	-
M12	26(1A)	Output voltage	[3]	-	68(44)	-	-

M13	27(1B)	Operation command (Final data)	[11]	-	69(45)	-	-
M14	28(1C)	Operating state	[13]	F00	70(46)	Data protection	[1]
M15	29(1D)	Y1-Y5 output terminal data	[12]	F01	71(47)	Frequency command 1	[1]
M16	30(1E)	Fault memory 0	[1]	F02	72(48)	Operation method	[1]
M17	31(1F)	Fault memory (1st prior)	[1]	F03	73(49)	Maximum output frequency 1	[1]
M18	32(20)	Fault memory (2nd prior)	[1]	F04	74(4A)	Base frequency 1	[1]
M19	33(21)	Fault memory (3rd prior)	[1]	F05	75(4B)	Rated voltage 1	[1]
M20	34(22)	Operating time	[1]	F06	76(4C)	Maximum output voltage 1	[1]
M21	35(23)	DC link circuit voltage	[1]	F07	77(4D)	Acceleration time 1	[10]
-	36(24)	-	-	F08	78(4E)	Deceleration time 1	[10]
M23	37(25)	Type code	[14]	F09	79(4F)	Torque boost 1	[3]
M24	38(26)	Capacity code	[9]	F10	80(50)	Electronics thermal overload relay 1 (Selection)	[1]
M25	39(27)	ROM version	[1]				
M26	40(28)	Transmission error processing Code	[1]	F11	81(51)	Electronics thermal overload relay 1 (Level)	[10]
M27	41(29)	Setting frequency at alarming (Final data)	[2]	F12	82(52)	Electronics thermal overload relay 1	[3]
				F13	83(53)	Electronics thermal overload relay (Braking resistor)	[1]
-	42(2A)	-	-				
-	43(2B)	-	-	F14	84(54)	Restart after momentary power failure (Selection)	[1]
-	44(2C)	-	-				

*1) 999 is treated as $7FFF_H$.

Code	Communication No. decimal (Hex.)	Name	Data Format
F15	85(55)	Frequency limiter (High)	[1]
F16	86(56)	Frequency limiter (Low)	[1]
F17	87(57)	Gain (for frequency setting signal)	[3]
F18	88(58)	Bias frequency	[4]
F20	89(59)	DC brake (Starting frequency)	[3]
F21	90(5A)	DC brake (Braking level)	[1]
F22	91(5B)	DC brake (Braking time)	[3]
F23	92(5C)	Starting frequency	[3]
F24	93(5D)	Starting frequency (Holding time)	[3]
F25	94(5E)	Stop frequency	[3]
F26	95(5F)	Motor sound (Carrier frequency)	[1] *1
F27	96(60)	Motor sound (Sound tone)	[1]
F30	97(61)	FMA terminal (Voltage adjust)	[1]
F31	98(62)	FMA terminal (Function selection)	[1]
F33	99(63)	FMP terminal (Pulse rate multiplier)	[1]
F34	100(64)	FMP terminal (Voltage adjust)	[1]
F35	101(65)	FMP terminal (Function selection)	[1]
F36	102(66)	30Ry operation mode	[1]
F40	103(67)	Torque limit 1 (Driving)	[1]
F41	104(68)	Torque limit 1 (Braking)	[1]
F42	105(69)	Torque vector control 1	[1]
E01	106(6A)	X1 terminal function	[1]
E02	107(6B)	X2 terminal function	[1]
E03	108(6C)	X3 terminal function	[1]
E04	109(6D)	X4 terminal function	[1]
E05	110(6E)	X5 terminal function	[1]
E06	111(6F)	X6 terminal function	[1]
E07	112(70)	X7 terminal function	[1]
E08	113(71)	X8 terminal function	[1]
E09	114(72)	X9 terminal function	[1]
E10	115(73)	Acceleration time 2	[10]
E11	116(74)	Deceleration time 2	[10]

Code	Communication No. decimal (Hex.)	Name	Data Format
E37	135(87)	Overload early warning 2 (level)	[10]
E40	136(88)	Display coefficient A	[10]
E41	137(89)	Display coefficient B	[10]
E43	138(8A)	LED monitor (Display selection)	[1]
E44	139(8B)	LED monitor (Display at STP mode)	[1]
E45	140(8C)	LCD monitor (Display selection)	[1]
C01	141(8D)	Jump frequency 1	[1]
C02	142(8E)	Jump frequency 2	[1]
C03	143(8F)	Jump frequency 3	[1]
C04	144(90)	Jump frequency (Width)	[1]
C05	145(91)	Multi-step frequency 1	[5]
C06	146(92)	Multi-step frequency 2	[5]
C07	147(93)	Multi-step frequency 3	[5]
C08	148(94)	Multi-step frequency 4	[5]
C09	149(95)	Multi-step frequency 5	[5]
C10	150(96)	Multi-step frequency 6	[5]
C11	151(97)	Multi-step frequency 7	[5]
C20	152(98)	Jogging frequency	[5]
C30	153(99)	Frequency setting 2	[1]
C31	154(9A)	Analog input offset (terminal 12) / Analog input bias (terminal 12)	[4]
C32	155(9B)	Analog input offset (terminal C1) / Analog input gain (terminal 12)	[4]
C33	156(9C)	Analog filter	[5]
P01	157(9D)	Motor 1 (Number of poles)	[1]
P02	158(9E)	Motor 1 (Capacity)	[5]
P03	159(9F)	Motor 1 (Rated current)	[10]
P05	161(A1)	Motor 1 (On-line tuning)	[1]
P06	162(A2)	Motor 1 (No-load current)	[10]
P07	163(A3)	Motor 1 (%R1)	[5]
P08	164(A4)	Motor 1 (%X)	[5]
P09	165(A5)	Motor 1 (Slip compensation control)	[5]

E12	117(75)	Acceleration time 3	[10]	H03	166(A6)	Data initializing	[1] *2
E13	118(76)	Deceleration time 3	[10]	H04	167(A7)	Auto-reset (Times)	[1]
E14	119(77)	Acceleration time 4	[10]	H05	168(A8)	Auto-reset(Reset interval)	[1]
E15	120(78)	Deceleration time 4	[10]	H06	169(A9)	Fan stop operation	[1]
E16	121(79)	Torque limiter 1 (Driving)	[1]	H07	170(AA)	ACC/DCC pattern (Mode selection)	[1]
E17	122(7A)	Torque limiter 1 (Braking)	[1]	H08	171(AB)	Reverse phase sequence lock	[1]
E20	123(7B)	Y1 terminal function	[1]	H09	172(AC)	Start mode (Pick-up mode)	[1]
E21	124(7C)	Y2 terminal function	[1]	H10	173(AD)	Energy-saving operation	[1]
E22	125(7D)	Y3 terminal function	[1]	H11	174(AE)	Deceleration mode	[1]
E23	126(7E)	Y4 terminal function	[1]	H12	175(AF)	Instantaneous overcurrent limiting	[1]
E24	127(7F)	Y5A, Y5C terminal functions	[1]	H13	176(B0)	Auto-restart (Restart time)	[3]
				H14	177(B1)	Auto-restart (Frequency fall rate)	[5]
E30	128(80)	Frequency arrival (FAR) (Detecting width)	[3]	H15	178(B2)	Auto-restart (Holding DC voltage)	[1]
				H16	179(B3)	Auto-restart (OPR command selfhold time)	[3] *3
E31	129(81)	Frequency detection 1 (FDT) (level)	[1]				
				H18	180(B4)	Torque control (Mode selection)	[1]
E32	130(82)	Frequency detection (FDT) (Hysteresis width)	[3]	H19	181(B5)	Active drive	[1]
				H20	182(B6)	PID control (Mode selection)	[1]
E33	131(83)	Overload early warning (Mode selection)	[1]	H21	183(B7)	PID control (Feed back signal)	[1]
				H22	184(B8)	PID control (P-Gain)	[5]
E34	132(84)	Overload early warning 1 (level)	[10]	H23	185(B9)	PID control (I-time)	[3]
E35	133(85)	Overload early warning (Timer time)	[3]	H24	186(BA)	PID control (D-time)	[5]
E36	134(86)	Frequency detection 2 (FDT) (level)	[1]	H25	187(BB)	PID control (Feedback filter)	[3]

*1) 0.75 kHz is treated as 0000H
*2) The communication might not be able to be continued by writing (data 1).
*3) 999 is treated as 03E7H (99.9).

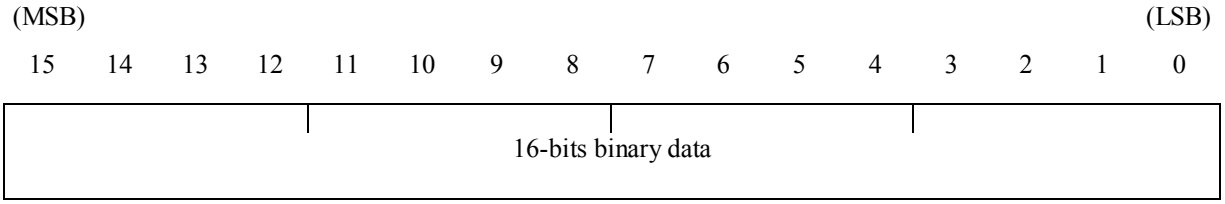
Code	Communication No. decimal (Hex.)	Name	Data Format	Code	Communication No. decimal (Hex.)	Name	Data Format
H26	188(BC)	PTC thermistor (Mode selection)	[1]	o36	235(EB)	Bus Configuration Parameter 07	[1]
H27	189(BD)	PTC thermistor (Level)	[5]	o37	236(EC)	Bus Configuration Parameter 08	[1]
H28	190(BE)	Droop operation	[4]	o38	237(ED)	Bus Configuration Parameter 09	[1]
H30	191(BF)	Serial link (Function selection)	[1]	o39	238(EE)	Bus Configuration Parameter 10	[1]
H31	192(C0)	RS485 (Address)	[1] *1	o40	239(EF)	Bus Configuration Parameter 11	[1]
H32	193(C1)	RS485 (Mode selection on error)	[1] *1	o41/	240(F0)	Bus Configuration Parameter 12/	[1] /
H33	194(C2)	RS485 (Timer time)	[3] *1	(o09)		Base side number of encoder pulses	[1]
H34	195(C3)	RS485 (Baud rate)	[1] *1	o42/	241(F1)	Bus Configuration Parameter 13/	[1] /
H35	196(C4)	RS485 (Data length)	[1] *1	(o10)		Time constant of pulse train input filter	[7]
H36	197(C5)	RS485 (Parity check)	[1] *1	o43/	242(F2)	Bus Configuration Parameter 14/	[1] /
H37	198(C6)	RS485 (Stop bits)	[1] *1	(o11)		Command pulse compensation coefficient 1	[1]
H38	199(C7)	RS485 (No response detection time)	[1] *1	o44/	243(F3)	Bus Configuration Parameter 15/	[1] /
H39	200(C8)	RS485 (Response interval)	[5] *1	(o12)		Command pulse compensation coefficient 2	[1]
A01	201(C9)	Maximum frequency 2	[1]	o45/	244(F4)	Bus Configuration Parameter 16/	[1] /
A02	202(CA)	Base frequency 2	[1]	(o13)		Main speed regulator gain	[3]
A03	203(CB)	Rated voltage 2 (at base speed)	[1]	o46/	245(F5)	Bus Configuration Parameter 17/	[1] /
A04	204(CC)	Maximum output voltage 2	[1]	(o14)		APR P gain	[5]
A05	205(CD)	Torque boost 2	[3]	o47/	246(F6)	Bus Configuration Parameter 18/	[1] /
A06	206(CE)	Electronics thermal 2 (Selection)	[1]	(o15)		Z phase matching gain	[3]
A07	207(CF)	Electronics thermal 2 (Level)	[10]	o48/	247(F7)	Bus Configuration Parameter 19/	[1] /
A08	208(D0)	Electronics thermal 2 (Thermal time constant)	[3]	(o16)		Offset angle	[1]
				o49/	248(F8)	Bus Configuration Parameter 20/	[1] /
A09	209(D1)	Torque vector control 2	[1]	(o17)		Detecting angle width for completion of synchronizing	[1]
A10	210(D2)	Motor 2 (Number of motor-2 poles)	[1]				
A11	211(D3)	Motor 2 (Capacity)	[5]	o50/	249(F9)	Bus Configuration Parameter 21/	[1] /
A12	212(D4)	Motor 2 (Rated current)	[10]	(o18)		Too mach deviation	[1]
A14	214(D6)	Motor 2 (On-line tuning)	[1]				
A15	215(D7)	Motor 2 (No load current	[10]				
A16	216(D8)	Motor 2 (%R1 setting)	[5]				
A17	217(D9)	Motor 2 (%X setting)	[5]				
A18	218(DA)	Motor 2 (Slip compensation control 2)	[5]				
o01	219(DB)	Speed command system /	[15]				

		automatic speed control system					
o02	220(DC)	Time constant of PG vector and speed command filter	[7]				
o03	221(DD)	Number of feedback PG pulses	[1]				
o04	222(DE)	Constant P of feedback speed Controller	[5]				
o05	223(DF)	Constant I of feedback speed Controller	[7]				
o06	224(E0)	Time constant of feedback speed detection filter	[7]				
o07	225(E1)	Feedback pulse correction coefficient 1	[1]				
o08	226(E2)	Feedback pulse correction coefficient 2	[1]				
o27	227(E3)	Mode selection on error	[1]				
o28	228(E4)	Timer time setting	[3]				
o30	229(E5)	Bus Configuration Parameter 01	[1]				
o31	230(E6)	Bus Configuration Parameter 02	[1]				
o32	231(E7)	Bus Configuration Parameter 03	[1]				
o33	232(E8)	Bus Configuration Parameter 04	[1]				
o34	233(E9)	Bus Configuration Parameter 05	[1]				
o35	234(EA)	Bus Configuration Parameter 06	[1]				

*1) Read-only from communication.

Data format specification

All data within the data field of the communication frame consist of 16 bits binary data.



(Negative data is treated with two's complement.)

Data format [1] Integer data (Positive): Min. unit 1
Example) If F15 (Frequency limiter, high limit) = 60 Hz,
60 * 1 = 60 = $003C_H$ -> | 0 | 0 | 3 | C |

Data format [2] Integer data (Positive, negative): Min. unit 1
Example) If F18 (Bias frequency) = -20 Hz,
-20 * 1 = -20 = $FFEC_H$(two's complement) -> | F | F | E | C |

Data format [3] Decimal data (Positive): Min. unit 0.1
Example) If F17 Gain (for frequency setting signal) = 100.0%,
100.0 * 10 = 1000 = $03E8_H$ -> | 0 | 3 | E | 8 |

Data format [4] Decimal data (Positive, negative): Min. unit 0.1
Example) If H28 (Droop operation) = -5.0Hz,
-5.0 * 10 = -50 = $FFCE_H$(two's complement) -> | F | F | C | E |

Data format [5] Decimal data (Positive): Min. unit 0.01
Example) If C05 (Multi-step frequency 1) = 50.25 Hz,
50.25 * 100 = 5025 = $13A1_H$ -> | 1 | 3 | A | 1 |

Data format [6] Decimal data (Positive, negative): Min. unit 0.01
Example) If M07 (Actual torque value) = -85.38%,
-85.38 * 100 = -8538 = $DEA6_H$(two's complement) -> | D | E | A | 6 |

Data format [7] Decimal data (Positive): Min. unit 0.001
Example) If o05 (Constant I of feedback speed controller) = 0.105s,
0.105 * 1000 = 105 = 0069_H -> | 0 | 0 | 6 | 9 |

Data format [8] Decimal data (Positive, negative): Min. unit 0.001

Example) If being -1.234,
-1.234 * 1000 = -1234 = $FB2E_H$(two's complement) -> | F | B | 2 | E |

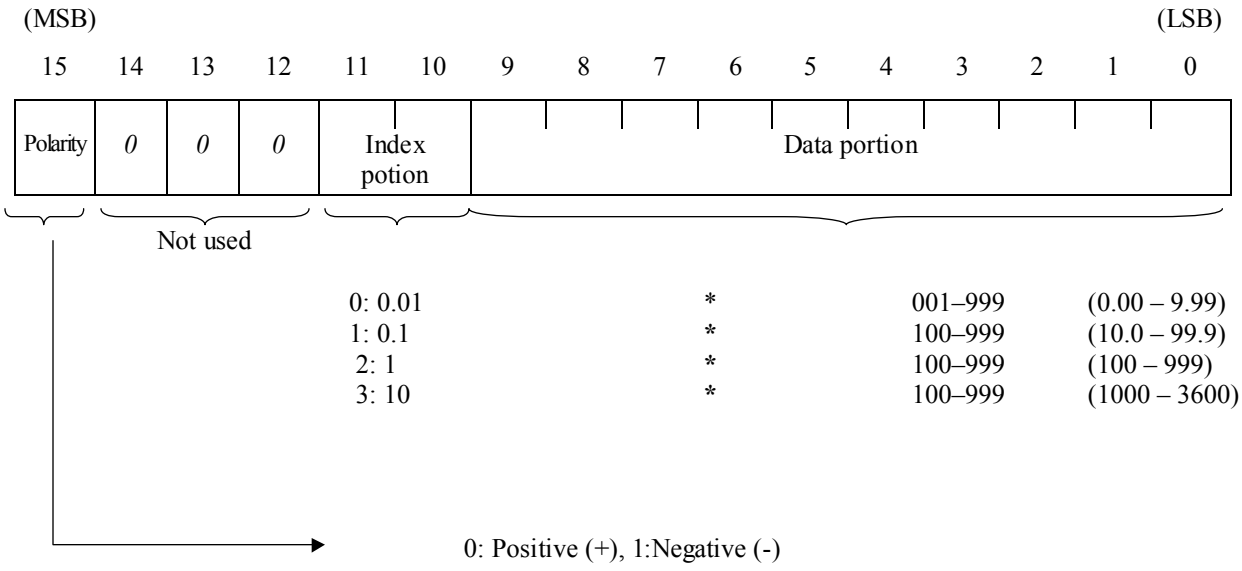
Data format [9] **Capacity code**

Code	Capacity (kW)	Code	Capacity (kW)	Code	Capacity (kW)
5	0.05	1100	11	11000	110
10	0.1	1500	15	13200	132
20	0.2	1850	18.5	16000	160
40	0.4	2200	22	20000	200
75	0.75	3000	30	22000	220
150	1.5	3700	37	25000	250
220	2.2	4500	45	28000	280
370	3.7	5500	55	31500	315
550	5.5	7500	75	35500	355
750	7.5	9000	90	40000	400

Example) If 30kW
Since 30 * 100 = 3000 = $0BB8_H$ ->

0	B	B	8

Data format [10] **Exponential data (ACC/DEC time, current value, display coefficient)**



Example) F07 (Acceleration time 1) = 20.0 s,
20.0 = 0.1 * 200 ->

0	4	C	8

Data format [11] **Operation command**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(RST)	*0*	*0*	*0*	*0*	X9	X8	X7	X6	X5	X4	X3	X2	X1	REV	FWD

Alarm reset command — Not used — Multi-function command — FWD: Forward rotation command; REV: Reverse rotation command

(All bits are ON by 1)

Example) If M13 (Operation command, Final command) = FWD, X1, X5 = ON,
$0000\ 0000\ 0100\ 0101_b = 0045_H$ ->

0	0	4	5

Data format [12] **Universal output terminal**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	Y5	Y4	Y3	Y2	Y1

Not used — Universal command

(All bits are ON by 1)

Example) If M15 (Universal output terminal) = Y1, Y5 = ON,
$0000\ 0000\ 0001\ 0001_b = 0011_H$ ->

0	0	1	1

Data format [13] Operating status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	WR		RL	ALM	DEC	ACC	IL	VL	TL	NUV	BRK	INT	EXT	REV	FWD

(All bit are ON or active by 1)

FWD: In forward operation
REV: In reverse operation
EXT: In DC braking (or in pre-excitation)
INT: Inverter Base Of
BRK: In braking
NUV: DC link voltage is establishment (Undervoltage condition at 0)
TL: In torque limiting
VL: In voltage limiting
IL: In current limiting
ACC: In acceleration
DEC: In deceleration
ALM: Alarm
RL: Transmission valid
WR: Function writing right
0: Keypad panel
1: RS485
2: Link (option)

Example) Omitted (Monitoring method is similar as in the formats [11] and [12].)

Data format [14] Type code

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Unit type				Generation				Series				Voltage series			

Code	Type	Generation	Series	Voltage series
1	VG	11th series	For Japan	100V single phase
2	G	-	For Asia	200V single phase
3	P	-	For China	200V three phase
4	E	-	For Europe	400V three phase
5	C	-	For USA	575V three phase
6	S	-	-	-

Data format [15] **Code setting (1 – 4 figures)**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data 4				Data 3				Data 2				Data 1			

Example) If "o22:Ai function selection" = 123,
Since $123 = 0123_H$ ⇒

0	1	2	3

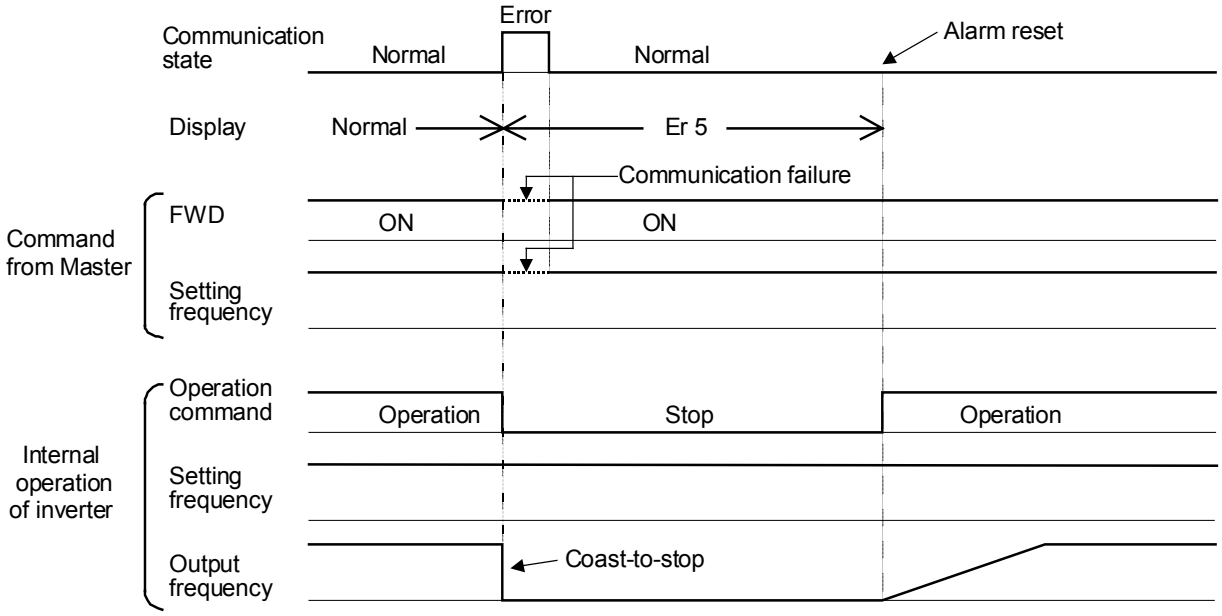
Action at communication error

In case of occurring transmission errors (communication cutoff with the master), the following actions can be selected.

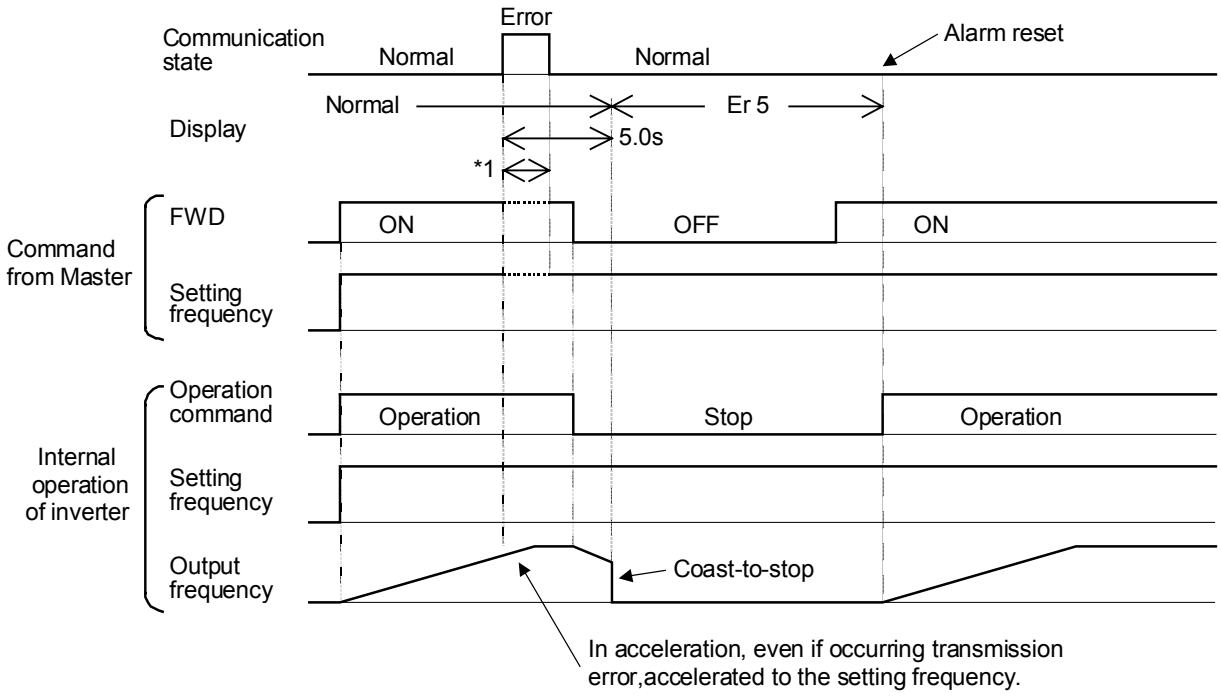
1) Select action when error is detected. (o27)

o27	Action at error detection		Remarks
0	Immediate forced stop	Er5	
1	Continue operation within o28 time and stop	Er5	Continue operation using the command just before the error within o28 time, but when restoring, operate following to the designation of communication.
2	Continue operation according to the last command received until restoration of the communication. If the communication is not restored before the o28 time expires, then immediate forced stop	Er5	
3	Continue operation till restoration of the communication, and after the restoration, follow to designation of communication.	Automatic restoration after restoring communication	

2) Setting time of timer at error (o28)
0.0 – 60.0s
In a case of o27=0 (Mode of immediate forced stop at communication error detection)

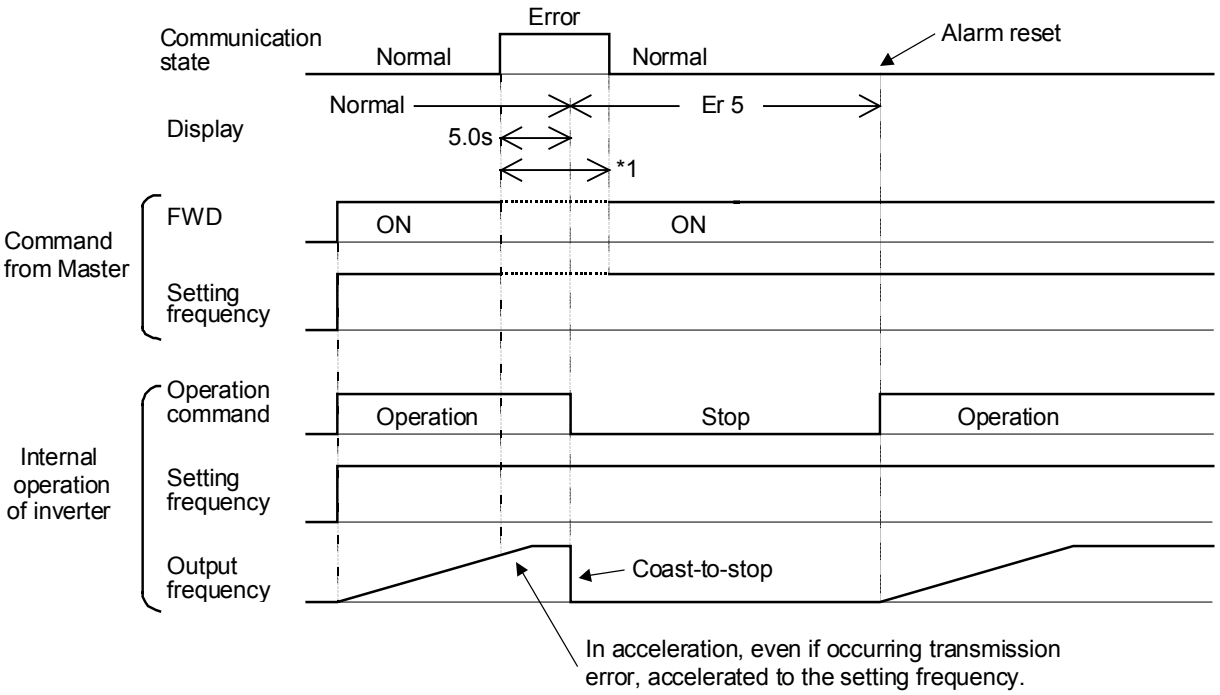


In a case of o27=1, o28=5.0 s (Mode of immediate forced stop after 5 s at occurring communication error)

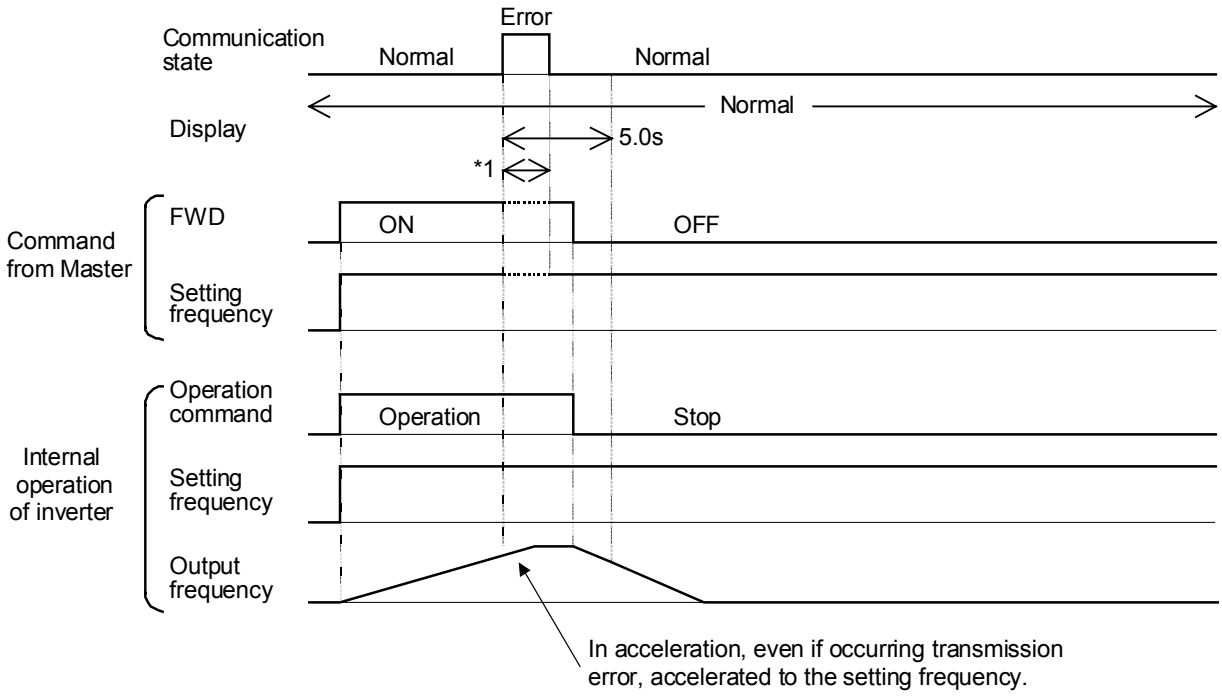


*1) In a period until restoring the communication, the last commands (command data and operation data) received before the error are kept.

In a case of o27=2, o28=5.0 s (The communication is not restored for 5.0 sec after error detection, and inverter trips Er5.)



In a case of o27=2, o28=5.0 s (A communication error occurs, but restored within 5 s.)



*1) In a period until restoring the communication, the commands (command data and operation data) just before the error are kept.

In a case of o27=3 (When a communication error occurs, the operation continues)