Fieldbus Interfaces FAQ

Handled by	Updated	Pages
Administrator	2010	1 (17)

Introduction

This FAQ contains questions and answers regarding ABB Drives' fieldbus interfaces. Purpose of this document is to help users to solve the most common problems on the field and give some basic information on 'good to know' matters.

If you have comments regarding the questions below or ideas to improve the Fieldbus - Frequently Asked Questions document, please contact mika.j.karna@fi.abb.com.

Terms used in this document:

Fieldbus	Digital communication network used in industry
Fieldbus adapter	Interface card that enables digital communication between devices and systems
Embedded fieldbus	Fieldbus protocol is inbuilt to a device e.g. drive
DDCS	Optical communication protocol developed by ABB
N-series adapters	Fieldbus adapter family developed by ABB Drives that uses DDCS as an interface to drives
NETA-01	N-series Modbus/TCP adapter with in-build web pages
NPBA-12	N-series Profibus adapter
NCAN-02	N-series CANopen adapter
NDNA-02	N-series DeviceNet adapter
NIBA-01	N-series Interbus adapter
R-series adapters	Plug-in fieldbus adapter family developed by ABB Drives
RMBA-01	R-series Modbus adapter
RPBA-01	R-series Profibus adapter
RDNA-01	R-series DeviceNet adapter
RCNA-01	R-series ControlNet adapter
RCAN-01	R-series CANopen adapter

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RLON-01	R-series LonWorks adapter
RETA-01	R-series Modbus TCP and Ethernet/IP adapter
RETA-02	R-series Modbus/TCP and PROFInet adapter
F-series adapters	Plug-in fieldbus adapter family developed by ABB Drives
FPBA-01	F-series Profibus adapter
FCAN-01	F-series CANopen adapter
FDNA-01	F-series DeviceNet adapter
FLON-01	F-series Lonworks adapter
FMBA-01	F-series Modbus adapter
ACS350	ABB General machinery drive
ACS550	ABB Standard drive
ACH550	ABB Drive for HVAC applications
ACS800	ABB Industrial drive
ACSM1	ABB Machinery drive

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Fieldbus compatibility

1. What fieldbus protocols does the General machinery drive ACS350 support?

ACS350 is using ABB Drives F-series fieldbus modules. At the moment it supports (v2.41a onwards):

- PROFIBUS DPV0 / DPV1 (FPBA-01)
- DeviceNet (FDNA-01)
- CANopen (FCAN-01)
- Modbus (FMBA-01), see question two for more information on embedded protocols in ACS350 drive.

2. What embedded protocols does the General machinery drive ACS350 support?

ACS350 supports Modbus RTU as an embedded protocol. The bus cable can be connected using the drive's panel connector (RS-232), FMBA-01 Modbus adapter (RS-485) or FRSA-00 adapter (RS-485).

FMBA-01 adapter is sold as a separate kit (MRP code 68469881) or with a plus code +K458. FRSA-00 is sold as a separate kit containing 20 boards (MRP code 68677793). Comparison of the options:

	FMBA-01	FRSA-00	RS-232 (panel interface)
Noise immunity	Best	Good	Poor
Number of nodes	32	32	2 (point-to-point)
Max baud rate	5 Mbps (with ACS350 max 115 kbps)	~0.5 Mbps (with ACS350 max 115 kbps)	115 kbps
Max distance	1200 m	1200 m	3 m
RS-485 transceiver	5 V	3.3 V (Compatible with 5 V bus)	-
Termination	Built-in (jumper)	Built-in (jumper)	-
Diagnostics	LED's	-	-
RS-485 GND	Isolated from the drive I/O GND Available at connector	Same potential as drive I/O GND 100 ohm resistor between RS-485 GND and signal at connector (see Note 1. below)	
Cable Shield	Connected to the chassis via RC filter (Rev. G onwards)	Connected to the chassis via RC filter (Rev. D onwards)	Not connected
Connector	Detachable screw connector	Fixed screw connector	RJ-45
Mechanics	IP20, coated board	Bare board (coated)	-

Note 1. Main differences between FRSA-00 and ACS550 Modbus interface are:
- In ACS550 all electronics is on same board, while with FRSA-00 GND connection is done via pin header
- In ACS550 drive's digital I/O is isolated from the drive's analogue I/O, while with ACS350 both are at the same potential

3. What fieldbus protocols does the Standard drive ACS550 support?

ACS550 is using ABB Drives R-series fieldbus modules. At the moment it supports (v3.10b onwards):

- PROFIBUS DPV0 / DPV1 (RPBA-01)
- CANopen (RCAN-01)
- ControlNet (RCNA-01)
- DeviceNet (RDNA-01)
- Ethernet/IP (RETA-01)
- Modbus/TCP (RETA-01)
- LonWorks (RLON-01)
- See question 4 for more information on embedded protocols in ACS550 drive.

4. What embedded protocols does the Standard drive ACS550 support?

ACS550 has Modbus protocol as an embedded protocol using RS-485 interface. Modbus protocol can be used to control and monitor the drive if external fieldbus adapter is not used.

For more information refer to *ACS550-01 Drives User's Manual* [3AFE64804588 (English)].

5. What fieldbus protocols does ACH550 drive for HVAC applications support?

ACH550 is using ABB Drives R-series fieldbus modules. At the moment it supports (v3.10b onwards):

- PROFIBUS DPV0 / DPV1 (RPBA-01)
- CANopen (RCAN-01)
- ControlNet (RCNA-01)
- DeviceNet (RDNA-01)
- Ethernet/IP (RETA-01)
- Modbus/TCP (RETA-01)
- LonWorks (RLON-01)
- See question 6 for more information on embedded protocols in ACH550 drive.

6. What embedded protocols does ACH550 drive for HVAC applications support?

ACH550 drive has a standard RS485 interface at the control board's terminals X1:28.32. The interface provides the following embedded fieldbus (EFB) protocols:

- Modbus
- Metasys N2
- FLN
- BACnet.

For more information, refer to the *Embedded Fieldbus (EFB) Control Manual* [3AFE68320658 (English)].

7. What fieldbus protocols does Industrial drive ACS800 support?

ACS800 is using ABB Drives R-series and N-series fieldbus modules. ACS800 drive has multiple applications, which do not support all of the available fieldbus protocols. For example ACS800 Standard application supports the following (ASXR7280 onwards):

- PROFIBUS DPV0 / DPV1 (RPBA-01, NPBA-12)
- CANopen (RCAN-01, NCAN-02)
- ControlNet (RCNA-01)
- DeviceNet (RDNA-01, NDNA-01)
- Ethernet/IP (RETA-01)
- Modbus/TCP (RETA-01, NETA-01)
- LonWorks (RLON-01)
- Modbus RTU (RMBA-01)
- Interbus (NIBA-01)

8. Where can I found out, which fieldbus adapters are supported by different ACS800 applications?

Contact your ABB local office or Support-line and ask compatibility information for drives and fieldbus adapters. They can provide you the piece of information.

9. What fieldbus protocols does Machinery drive ACSM1 support?

ACSM1 uses F-series fieldbus adapters. Following protocols are supported:

- PROFIBUS (FPBA-01)
- CANopen (FCAN-01 Q2/07 onwards)
- DeviceNet (FDNA-01 Q3/07 onwards)
- Ethernet/IP (Q3/07 onwards)

10. What fieldbus protocols does DCS800 support?

DCS800 drive uses R-series fieldbus adapters. It currently supports the following fieldbus protocols:

- PROFIBUS DP (RPBA-01)
- DeviceNet (RDNA-01)
- CANopen (RCAN-01)
- ControlNet (RCNA-01)
- Modbus RTU (RMBA-01)
- Modbus/TCP (RETA-01)
- Ethernet/IP (RETA-01)

Fieldbus basics

11. What is a dataset?

Communication between a fieldbus system and the drive employs data sets.
One data set (abbreviated DS) consists of three 16-bit words called data words (DW).

For example, the ACS800 Standard Application Program supports the use of four data sets, two in each direction. The two data sets for controlling the drive are referred to as the Main Reference data set and the Auxiliary Reference data set. The sources from which the drive reads the Main and Auxiliary Reference data sets are defined by parameters 90.04 and 90.05 respectively. The contents of the Main Reference data set are fixed. The contents of the Auxiliary Reference data set can be selected using parameters 90.01, 90.02 and 90.03. The two data sets containing actual information on the drive are referred to as the Main Actual Signal data set and the Auxiliary Actual

Signal data set. The contents of both data sets are partly selectable with the parameters at group 92.

	Data from fieldbus controller to drive		
	Word	Contents	Selector
*Index	Main Reference data set DS1		
1	1st word	Control Word	(Fixed)
2	2nd word	Reference 1	(Fixed)
3	3rd word	Reference 2	(Fixed)
*Index	Auxiliary Reference data set DS3		
7	1st word	Reference 3	Par. 90.01
8	2nd word	Reference 4	Par. 90.02
9	3rd word	Reference 5	Par. 90.03

	Data from drive to fieldbus controller		
	Word	Contents	Selector
*Index	Main Actual Signal data set DS2		
4	1st word	Status Word	(Fixed)
5	2nd word	Actual 1	**Par. 92.02
6	3rd word	Actual 2	Par. 92.03
*Index	Aux. Actual Signal data set DS4		
10	1st word	Actual 3	Par. 92.04
11	2nd word	Actual 4	Par. 92.05
12	3rd word	Actual 5	Par. 92.06

12. How can I use reference 2 through a fieldbus?

Second reference is the third item in the drive's first dataset (See question 11). Third dataset items are not mapped into the protocols specific fixed set of outputs or inputs, which are transferred to and from the drive cyclically (e.g. assembly instances in case of CIP based protocols, standard telegrams or PPO types in case of Profibus).

To write to the second reference it has to be mapped as an output. To read the actual value 2, it has to be mapped as an input.

For example with RDNA-01 (DeviceNet) access to second reference and actual values is possible only through *User Specific Control Assembly* instances (102 / 103). The inputs and outputs of the assembly have to be mapped manually.

13. How to start and stop the drive with ABB Drives profile command word?

Here are the basic commands in hexadecimal and decimal formats. For more information on command word, status word and the state machine see e.g. *ACS800 Firmware Manual, ASC800 Standard Application 7.x* [3AFE64527592 (English)].

Case	Description	Command word (Hex)	Command word (Dec)	State after command (Status word)
1	Start the drive	0x47F	1151	OPERATING (0x1737)
2	Reset fault	0x48E	1166	READY TO SWITCH ON (0x1231)
3	Reset fault	0x480	1152	SWITCH-ON INHIBITED (0x1200)
4	Stop along currently active ramp (OFF1)	0x47E	1150	READY TO SWITCH ON (0x1231)
5	Emergency OFF, coast to stop (OFF2)	0x47D	1149	SWITCH-ON INHIBITED (0x1260)
6	Emergency stop within	0x47B	1147	SWITCH-ON

	specified time (Causes alarm if activated)			INHIBITED (0x1250)
7	Inhibit operation	0x477	1143	OPERATION INHIBITED (0x0233)

14. What is the priority of the OFFx CONTROL bits in the ABB Drives profile's command word?

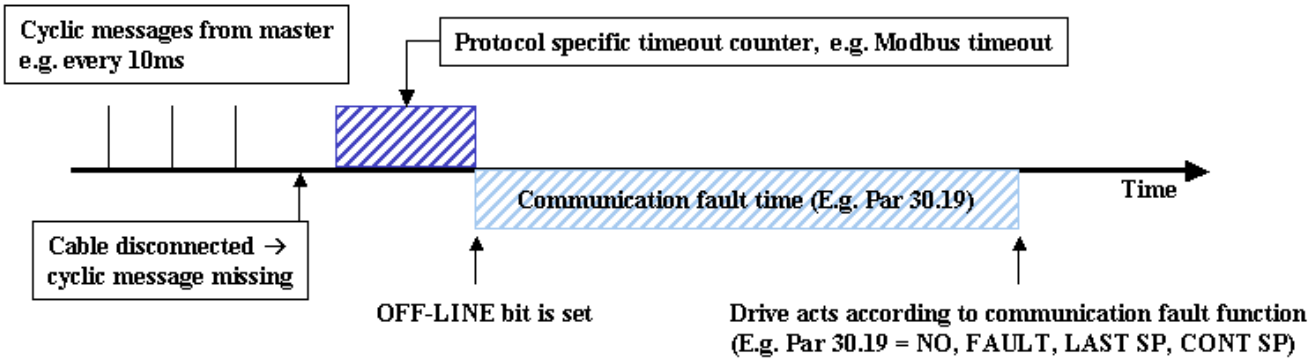
If multiple OFFx CONTROL bits are set simultaneously the drive acts according to the bit that has the highest priority (lowest value in the table below). Priorities are listed in the table below:

OFF CONTROL bit	Priority
OFF 1	3.
OFF 2	1.
OFF 3	2.

15. How does communication fault function work?

Communication fault is trigged when cyclic messages do not arrive from master station (Protocol master, Advant controller) to drive's main or auxiliary datasets on time.

Each fieldbus has a specific mechanism, which trigs a protocol specific timeout counter. The timeout value can usually be modified with a configuration file or set with a master station. After the specified time has elapsed, drives communication fault timer will start, which eventually causes a fault (See figure below).



Possible reasons for communication fault are:

- Disconnected or broken communication cable between the drive and the master
- Faulted master station
- Faulted network component
- Grounding problem and interference
- Incorrectly configured master station
- Incorrectly configured drive or fieldbus interface

Drive's behaviour to communication fault can be selected with drive parameters (E.g. ACS800 Standard application):

- Parameter 30.18 COMM FLT FUNC
  - NO: drive keeps its status
  - FAULT: drive generates a fault and stops
  - LAST PEED: drive continues to run with last speed and generates an alarm

        - CONST SP: drive starts to run with constant speed and generates an alarm.
    - Parameter 30.19 MAIN REF DS T-OUT
        - Time-out value in seconds
    - Parameter 30.21 AUX DS T-OUT
        - Time-out value in seconds

Some fieldbus protocols and adapters have additional features to extend the communication fault functionality. For more information on protocol specific features, see questions below.

16. How does the Modbus Time-out function work in RETA-01 and RETA-02?

RETA-01 and RETA-02 adapters have Modbus/TCP interface. Drive's communication fault function monitors the OFF-LINE status bit, which is *OFF* when the Ethernet link is up and *ON* when the link is down. The link stays up when RETA-01 or RETA-02 is connected to another Ethernet component, like a hub or switch. If Ethernet cable is disconnected or broken between the switch and the Modbus/TCP master the drive doesn't activate the communication fault.

To overcome this problem RETA-01 and RETA-02 adapters have a bus configuration parameter called *MODBUS TIME-OUT,* which is used to activate the communication fault in the described situation. When the adapter stops receiving Modbus/TCP messages it starts the *MODBUS TIME-OUT* timer. Drive's communication fault timer is started after Modbus time-out has elapsed. Drive acts according to communication fault function after the communication fault time has elapsed. If any of the Modbus/TCP registers is read or written before the time-out has elapsed, the counters are started again.

17. How does RETA-01 (Ethernet/IP), RDNA-01 (DeviceNet) and RCNA-01 (ControlNet) adapters work when the master station goes to IDLE state?

RETA-01, RDNA-01 and RCNA-01 adapters have object attributes for setting the drives behaviour when master station goes to IDLE state. There is a separate attribute for ABB Drives profile and for Generic profile.

Adapters have an attribute in the Configuration Object for setting the IDLE behaviour in ABB Drives profile. When set to 0 (Imitate, or Fault), the drive acts according to the communication fault function (Par30.18 in ACS800 Standard application). If the attribute is set to 1 (Ignore idle), the drive will ignore the IDLE state of the master and continue operation.

#	Name	Services	Description	Dflt,Min,Max	Data type
0x07	Idle Action	Get / Set	0 = Imitate communication fault function 1 = Ignore idle	0, 0, 1	UINT

In generic mode the adapters have an attribute in the Control Supervisor Object for setting the IDLE behaviour. When set to 0 (Stop), the drive stops when master state is set to IDLE. When set to 1 (Ignore) the drive will ignore the IDLE state of the master. If

the attribute is set to 2 (Imitate or fault), the drive acts according to the communication fault function (Par30.18 in ACS800 Standard application).

0x14	Net Idle Mode [5)]	Get/Set	0 = Stop (default) 1 = Ignore Idle 2 = Imitate communication fault function	USINT

18. Why isn't the RAMP_IN_ZERO bit of the ABB Drives control word working with ACS550 and ACS350?

To make the RAMP_IN_ZERO bit to work, parameter RAMP INPUT 0 (Par22.09) has to be set to COMM.

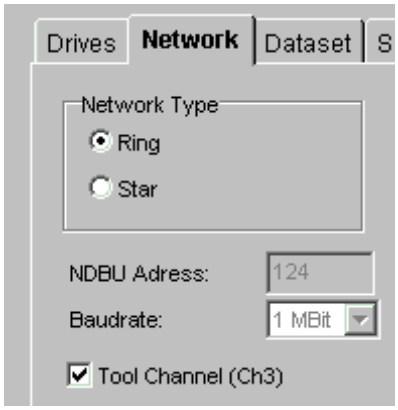
19. How does RETA-01 Ethernet adapter differ from NETA-01 intelligent Ethernet adapter?

The first main difference between NETA-01 and RETA-01 is that NETA-01 is targeted for monitoring and RETA-01 for control of drives. The second difference is that NETA-01 can be connected to multiple drives simultaneously through the optical link (DDCS), while RETA-01 serves only one drive. Comparison of the adapters:

RETA-01	**NETA-01**
R-series plug-in fieldbus adapter	N-series external fieldbus adapter that uses optical DDCS
Connected to one drive only	Can be connected to 9 drives simultaneously
Modbus/TCP and Ethernet/IP for control	Modbus/TCP for control
Response time: < 2,0 ms / sample	Response time: > 10ms / sample
Doesn't have inbuilt web pages	Inbuilt web pages for configuration and monitoring
Doesn't support email	Supports predefined email that can be trigged on events

20. Can I use NETA-01 adapter for monitoring and R-series adapter for control simultaneously?

With ACS800 you can. NETA-01 should be connected to channel 0 or 3 of the drive. When NETA-01 module is used only for monitoring the '*Tool Channel (Ch3)*' check box should be selected though the web interface (this is default).

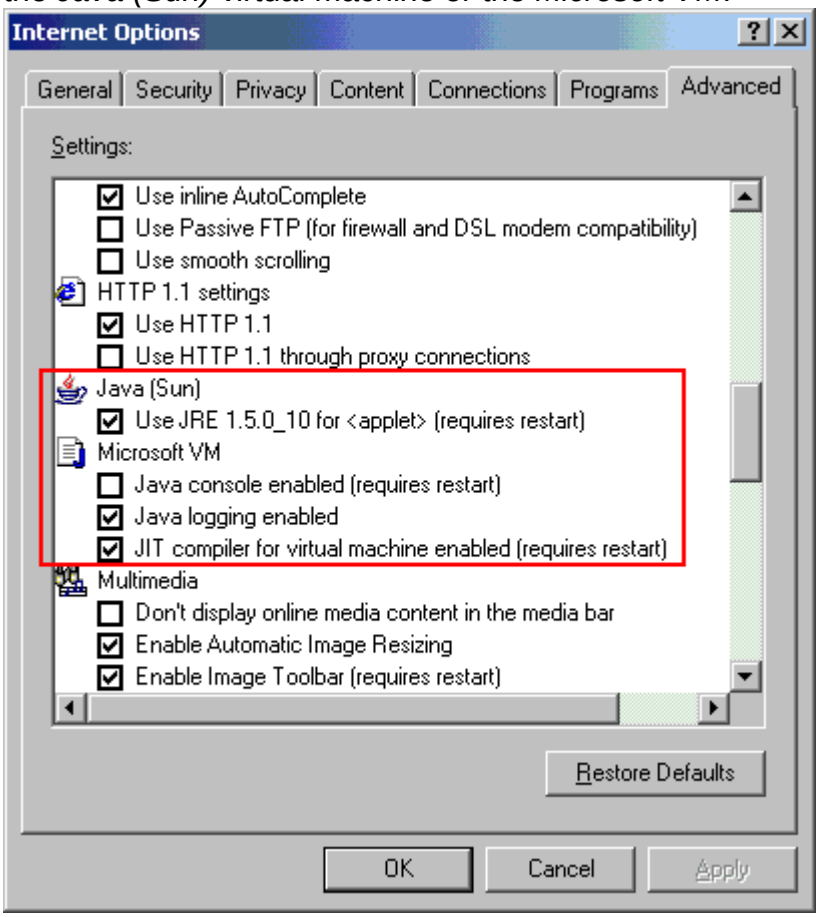


If the check box is not selected, the module will write the fieldbus configuration parameters and start controlling the drive. This will interfere the R-series adapter, which will loose its configuration and capabilities for control.

21. What is Java Virtual Machine and where can I get it?

Java Virtual Machine is browser plug-in software, which works as a sandbox for executing web applications, like Java Applets. Intelligent Ethernet adapter NETA-01 utilizes Java Applets in the user interface and thus requires the Java Virtual Machine.

Usually browsers have a Java Virtual Machine. Existence of the plug-in can be checked from the *Tools→Internet Options…* menu's *Advanced* tab. The browser can have either the *Java (Sun)* virtual machine or the *Microsoft VM*.



If the browser doesn't have a virtual machine, it can be downloaded from:

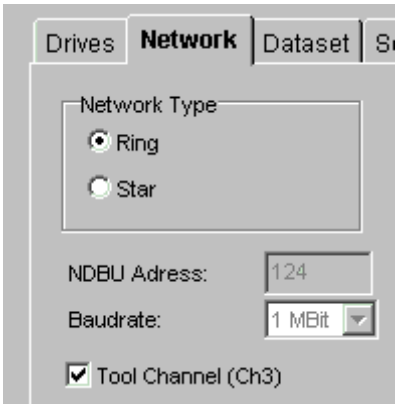
http://www.java.com/en/download/index.jsp

Follow the setup instructions for installing the plug-in software to your browser.

22. Which optical channel of the drive should NETA-01 be connected to?

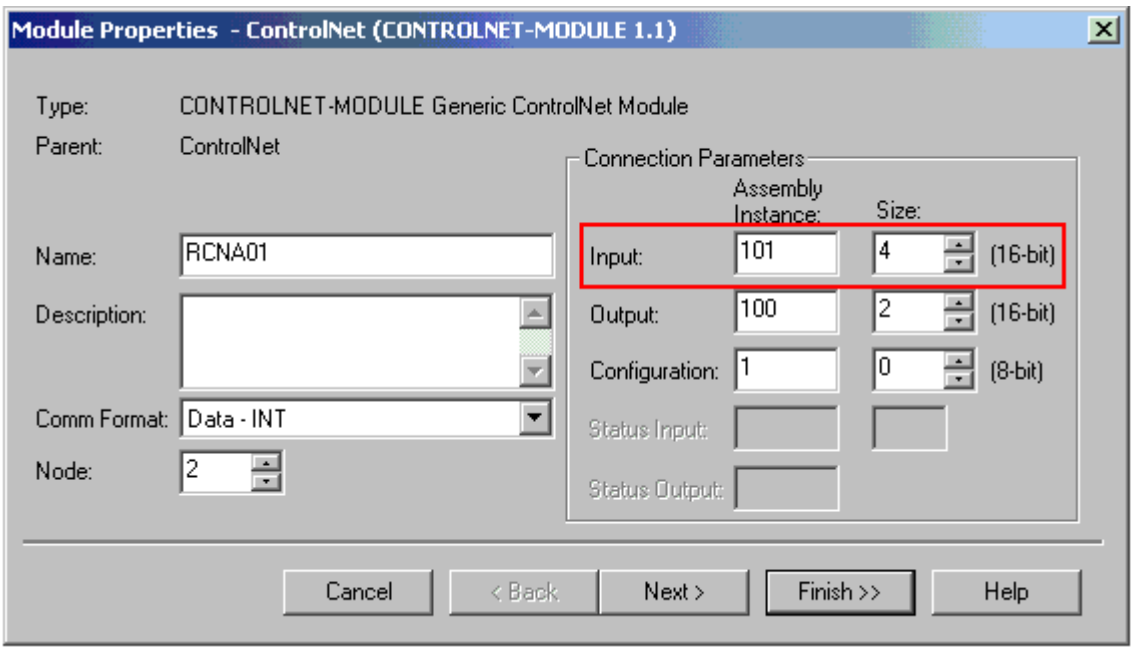
With ACS800 NETA-01 can be connected to channel 0 or channel 3 (Tool channel) of the drive. Some drive types also have channel 4, which can be used for remote diagnostics tools, like NETA-01.

If NETA-01 module is used only for monitoring the '*Tool Channel (Ch3)*' check box should be selected. If the check box is not selected, the module will write the fieldbus configuration parameters and start controlling the drive.



23. How to configure the Allen-Bradley Controllogix 5000 PLC for RCNA-01?

Allen-Bradley's ControlNet interface has two status words that ABB's RCNA-01 adapter cannot utlize. In the *GENERIC CONTRONET* MODULE's assembly configuration the input assembly needs two extra words to make the communication work between the drive and the PLC.



24. How to avoid network grounding problems that disturb fieldbus communication?

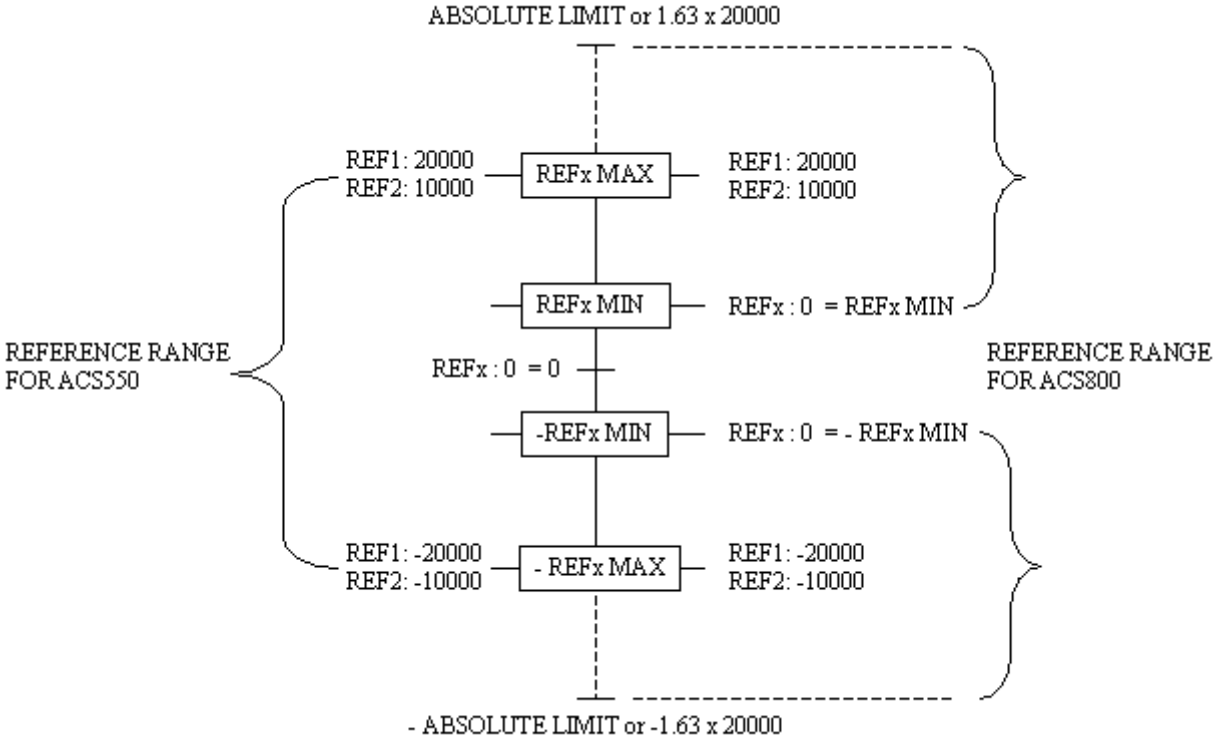
There are few simple instructions:

- Arrange the bus cables as far a way from the motor cables as possible and avoid parallel runs
- Fasten the grounding screw of the communication adapter
- Use correct cables
- Finalize the end of the cables properly.

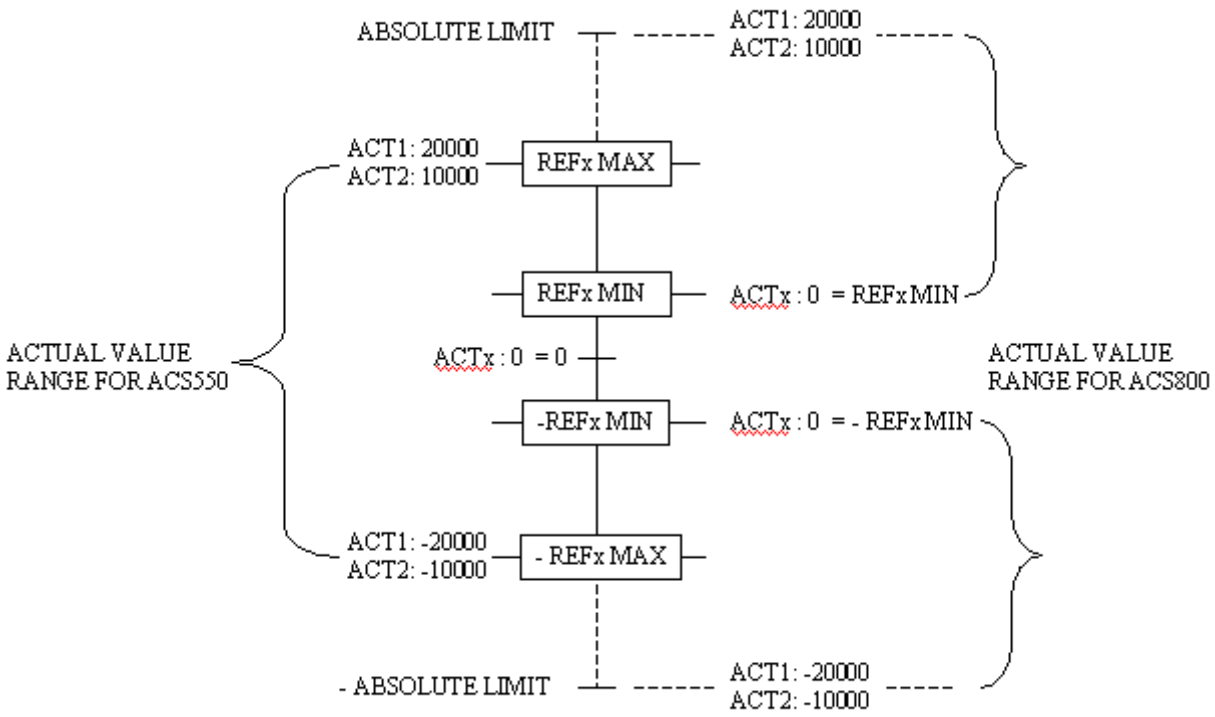
25. How are fieldbus references and actual signals scaled?

Scaling of references and actual signals depends on the drive type. See drive manuals for detailed description.

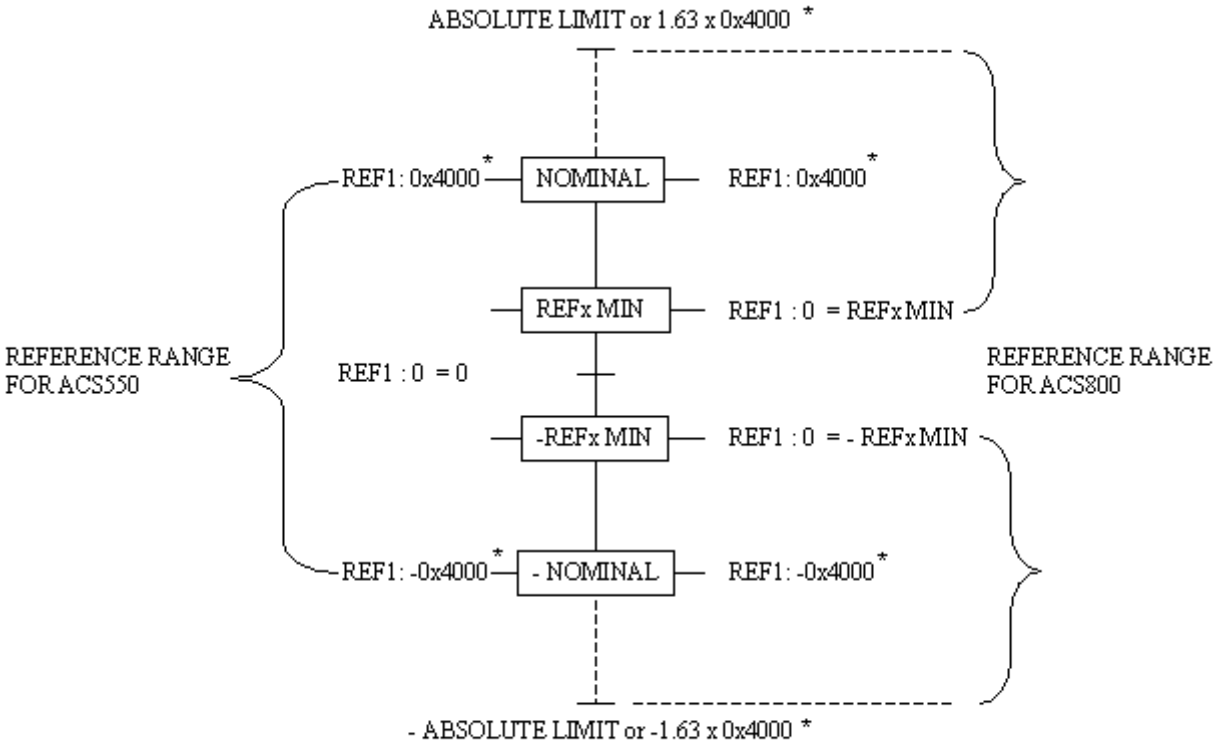
Reference scaling for ACS800 and ACx550 in ABB Drives profile:



Actual value scaling for ACS800 and ACS550:

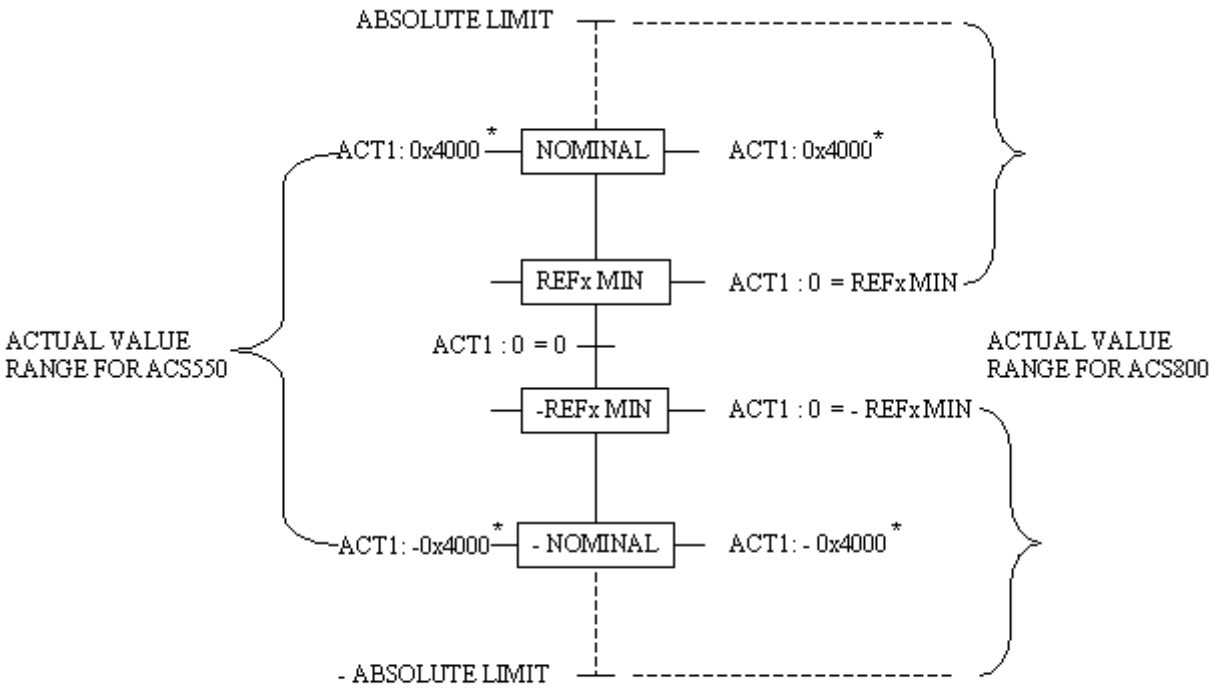


Reference scaling for ACS800 and ACS550 in Generic profile:



* Protocol specific. Example scaling from PROFIdrive.

Actual scaling for ACS550 and ACS800 in Generic profile:



* Protocol specific. Example scaling from PROFIdrive.

Master configuration files

26. What is a GSD file?

GSD (General Station Description) files are simple text files which are required to configure a PROFIBUS® network. GSD file is identified by an unique identity code and file name assigned by the PROFIBUS® User Organisation (PNO). The GSD file describes for example the transmission rates, operation mode (DP-V0, DP-V1) and PPO types supported, response times and format of the cyclic data the PLC receives from or sends to the device.

27. What GSD files should be used with RPBA-01 and FPBA-01?

For RPBA-01 module:

- ABB_0812.GSD for PROFIBUS-DPV0 slave mode
- ABB10812.GSD for PROFIBUS-DPV1 slave mode (RPBA-01 Rev. H onwards) *

* **NOTE:** If DPV1 mode is used the adapter configuration parameter DP MODE (51.21) should be set to ‘1’.

For FPBA-01 adapter:

- ABB0959.GSD for PROFIBUS-DPV0 slave
- Support for for PROFIBUS-DPV1 will be added during 2007

28. Where can I find GSD files for PROFIBUS adapters?

GSD files for ABB drives’ PROFIBUS adapters are available from www.profibus.com or from an ABB representative. Try also ABB Library: http://www.abb.com/ProductGuide

Follow links:

→ Motors, Drives and Power Electronics → Drives → Low Voltage AC Drives → Drive Options → Communication Options → *specific module (e.g. RPBA)*

29. Why is the PLC overwriting the ABB_0812.GSD file?

All RPBA-01 adapters have the same identification number. Some PLC's may overwrite the ABB_0812.GSD file with the newer ABB10812.GSD file, because the identification is the same and the revision is newer. The problem can be solved by using the DP-V0 protocol and the ABB_0812.GSD or by making sure that the PLC in use can separate the GSD files by name and not only by the identification number.

30. What is a GSDML file?

GSDML (General Station Description Markup Language) files are device description files used in PROFInet. Instead of using keyword language like in the GSD files, GSDML files are structured with XML, which is more powerful description language. The GSDML files describe for example device identity, device access points, modules, sub modules and their content.

31. What is an EDS file?

EDS files are simple text files used by network configuration tools such as DeviceNetManager™ and RSNetWorx™ to help you identify products and easily commission them on a network. EDS files describe product's device type, product revision and configurable parameters on a DeviceNet, ControlNet or Ethernet/IP network.

ABB Drives has two types of EDS files, typical and extended. Typical files have the required headers and fields to identify the drive type and adapter. Extended files also include parameter definition and provide access to drive parameters. Extended files can be requested from ABB representatives.

32. Where can I find EDS files for DeviceNet, ControlNet and Ethernet/IP?

Typical and some extended EDS files are available from ABB library:
http://www.abb.com/ProductGuide

Follow links:

→ Motors, Drives and Power Electronics → Drives → Low Voltage AC Drives → Drive Options → Communication Options → *specific module (e.g. RDNA)*

Extended EDS files can be requested from ABB representatives.

33. Can I modify EDS files?

Yes you can. Drive is recognized for example by the vendor code, product code, major and minor revision of the fieldbus adapter. Vendor code and product code should not be changed, but the revision fields in the device section can be modified to correspond to the existing adapters application version.

In case extended EDS file is used also the parameter visibility can be changed by modifying the parameter's 'descriptor' field. Adding value 0x0200 to the original value (e.g. 0x0010→ 0x0210) will hide the parameter and the network configuration tools ignore it.

```
$$$$    01.01 PROCESS VARIABLE
Param2 =
        0,                          $ data slot - don't care
        6,                          $ path length
        "20 90 24 01 30 01",        $ path (class, instance, attribute)
        0x0210,                     $ descriptor: 0x0010=use param, 0x0210=hide param
        0xC3,                       $ data type INT
        2,                          $ data size
        "01.01 PROCESS VARIABLE",
        "%",                        $ unit
        "See Firmware Manual, 01.01 PROCESS VARIABLE",
        -32768,32767,0,             $ min, max, default
        ,,,,                        $ mult, div, base, offset scaling
        ,,,,                        $ mult, div, base, offset links not used
        0;                          $ decimal places
```