Instruction manual

EXP-ETH2-IP-ADV200

EtherNet/IP interface expansion board

Summary

1. Introduction

This manual describes the option board **EXP-ETH2-IP-ADV200 (cod. S5L92)** to connect ADV200 series drives to Industrial Ethernet with EtherNet/IP protocol networks.

Only one fieldbus per drive expansion card can used.

This manual is intended for technicians and designers responsible for the maintenance, initial start-up and operation of Industrial Ethernet systems. A basic knowledge of Industrial Ethernet is therefore required.

The **EXP-ETH2-IP-ADV200** card can only be used with drives with firmware version **7.7.22 or higher**.

1.1 Features

- 2 EtherNet/IP 100 Mbit/s RJ-45 ports available simultaneously
- Beacon-based Device Level Ring (DLR)
- Control cycle duration from 1ms to 3200 ms
- Maximum input data length 32 bytes
- Maximum output data length 32 bytes
- Vendor ID= 853
- Modbus TCP/IP communication

1.2 What is EtherNet/IP?

EtherNet/IP is the name given to the CIP (Common Industrial Protocol) as implemented on Ethernet standard (IEEE 802.3 and the TCP/IP protocol suite).

EtherNet/IP is an industrial Ethernet solution available for the automation of machines and plants, based on the CIP (Common Industrial Protocol), an object-oriented protocol, based on a media-independent connection protocol designed for automation applications, which includes a set of comprehensive communication services for automation applications, "IP" in "EtherNet/IP" refers to "Industrial Protocol". It is built on the infrastructure network of the Ethernet physical layer and on TCP-IP protocol, and can therefore be used in automation networks that can tolerate a certain amount of non-determinism.

Among other things, this allows:

- I/O data transfer via implicit messaging based on User Datagram Protocol (UDP);
- data transfer via explicit messaging based on TCP protocol;
- "EtherNet/IP" uses TCP port number 44818 for explicit messaging and UDP port number 2222 for implicit messaging.

1.3 Safety

Before installing the board, carefully read the section on safety instructions in the manual "GuideADV200 Quick Start, Chapter 1 - Safety Precautions".

1.4 Assembly

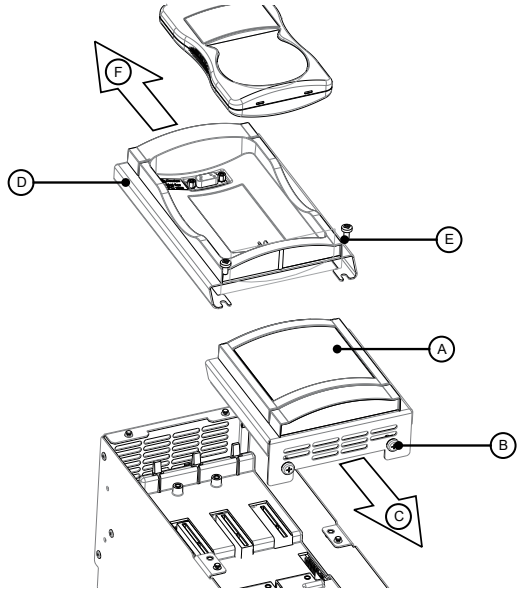
The EXP-ETH2-IP-ADV200 option board comes with the **EXP LOCK KIT (cod. S7BQO4P)** to secure lock and the board in the dedicated slot.

EXP LOCK KIT includes: No. 4 screws M3 x 8 mm + washer, No. 1 plastic fixing bar, No. 2 hexagonal spacers, No. 2 washers split M3.2, No. 1 metal shield (G) and .No. 1 screw M4 x 8 mm (H1).

1) To remove the lower cover (A) unscrew the 2 screws (B) and pull it out in the direction indicated (C), see figure 1.

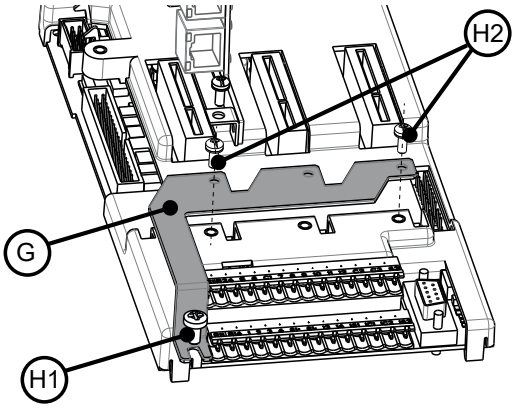
2) To remove the top cover (D) loosen by about the screws (E) and slide it off in the direction indicated (F), see figure 1.

Figure 1



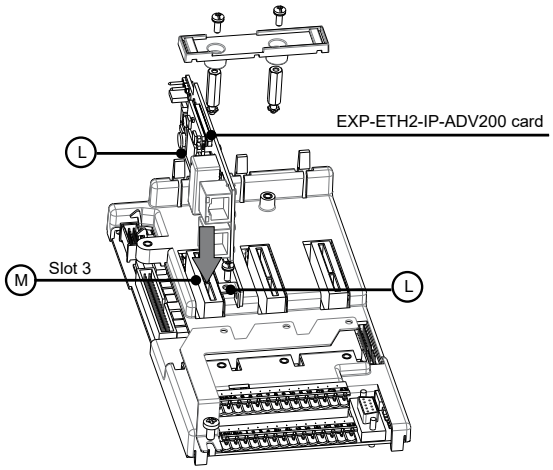
3) Position and secure the metal shield (G) with the NoM3x8 screws (H2) and No. 1 M4x8 (H1) as shown in figure 2.

Figure 2



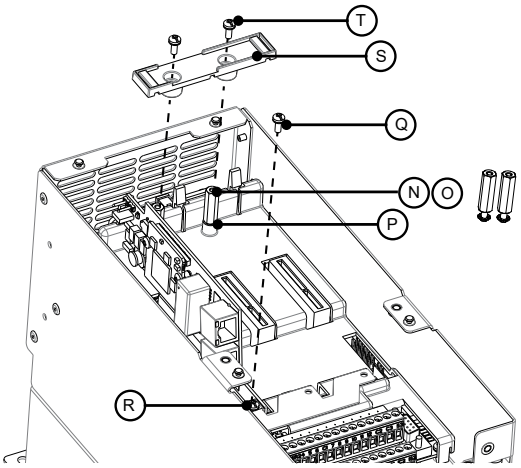
4) Place the EXP-ETH2-IP-ADV200 card in the dedicated Slot 3 as shownin Figure 3, align the ends of the card (L) in the slot, and then fully insert the card connector into the drive connector (M).

Figure 3



5) Fix the 2 hexagonal spacers (N) with the M3.2 split washers (O) at the fixing points (P); then fix the board with the M3 x 8 mm screw + washer (Q) at the point (R) and finally fix the plastic fixing bar (S) with the 2 M3 x 8 mm screws + washer (T) on the hexagonal spacers as shown in figure 4.

Figure 4



CAUTION!

Use only the supplied screws.

1.5 Links

Bus media

2 RJ-45 EtherNet/IP 100 Mbit/s ports.

Wiring considerations

To ensure reliability over time, it is recommended that all cables used to connect the system are checked using a suitable Ethernet cable especially when cabling is done on-site.

Cables

Cable problems are the biggest cause of network downtime. Verify that cables are properly routed, that wiring is correct, that connectors are properly installed, and that all switches and routers are for industrial use.

Office Ethernet equipments generally does not offer the same degree of noise immunity as industrial equipments.

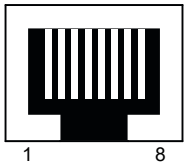
Maximum network length

The major restriction imposed on Ethernet cabling is the length of a single cable segment.

The module ADV-Industrial Ethernet has two 100BASE-TX Ethernet ports, supporting segment lengths of up to 100 m with cables of category 6 or higher.

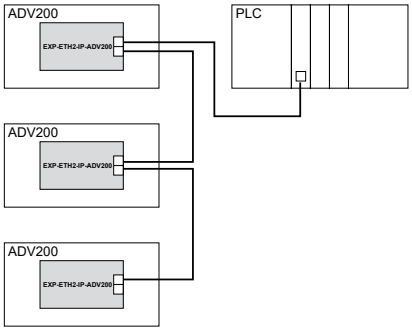
ADV-Industrial Ethernet terminal descriptions

The ADV EtherNet/IP module has two RJ45 Ethernet ports for the Industrial Ethernet network.

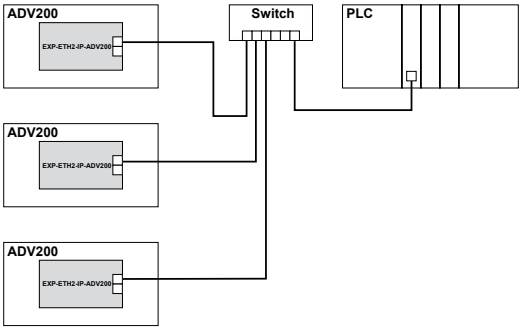
Ethernet interface (connectorsRJ45) 10/100Mbit , Ethernet interface full or half duplex operation		
Pin	**Port 1 IN/OUT (J1) Port 2 IN/OUT (J2)**	
4, 5, 7, 8	Connected to chassis earth via serial RC circuit	
6	RD-	
3	RD+	
2	TD-	
1	TD+	
Housing	Cable shielding	

Network topology

The connection between the devices can be done by "daisy chaining":



Or via switch:



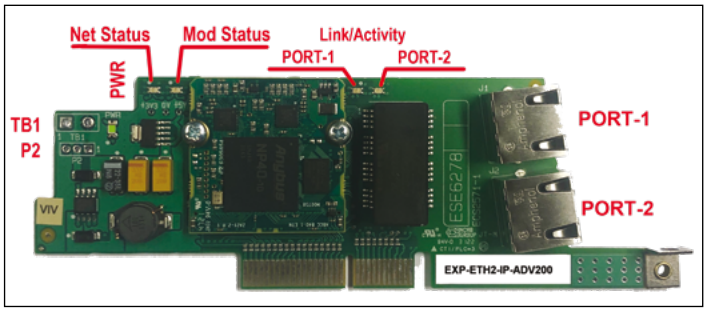
The two Ethernet ports are interchangeable, in the sense that no input and output port is defined the board behaves like an Ethernet switch.

Minimum node-to-node cable length

There is no minimum cable length recommended by Ethernet standards.

In order to avoid possible problems, it is recommended to leave sufficient cable length to ensure a good radius on the cable and avoid unnecessary strain on the connectors.

1.6 Led - Jumper - Terminal



1.6.1 Link/Activity LED (Green/Yellow)

LED Status	LED Description
Off	No link, no activity
Green	Link (100 Mbit/s) established
Green, flashing	Activity (100 Mbit/s)
Yellow	Link (10 Mbit/s) established
Yellow, flashing	Activity (10 Mbit/s)

LED Status	LED Description
PWR	Indicates the presence of the board power supply it (green) when the board is powered.

1.6.2 Network status LED (Green/Red)

LED Status	LED Description
Off	No power supply or no IP address
Green	Online, one or more connections established (CIP Class 1 or 3)
Green, flashing	Online, no connection established
Red	Duplicate , IP address FATAL error
Red, flashing	Timeout of one or more connections (CIP Class 1 or 3)

1.6.3 Module status LED (Green/Red)

LED Status	LED Description
Off	No power supply
Green	Controlled by a scanner in Run state and, if CIP Sync is enabled, the time is synchronised with a Grandmaster clock
Green, flashing	Online, no connection established
Red	Serious error (status EXCEPTION, FATAL error, etc.)
Red, flashing	Reversible defect(s). The module configured, but the stored parameters differ from the currently used parameters.

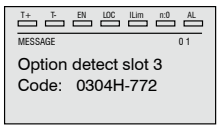
1.6.4 Jumper

Reference	Description
P2	If the terminals are mounted, the jumper must be installed in position 2-3.

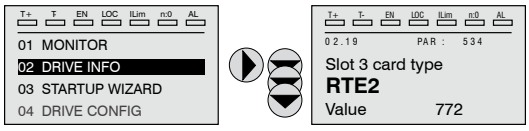
1.6.5 Terminal

Reference	Description
TB1	If the contacts are mounted, they must be left NOT CONNECTED.

1.7 Optional Card Recognition



At power-up, the drive recognises the presence of option card in the expansion slot 3, and this message appears on the display.



On the 02 DRIVE INFO menu, select PAR 534 **Card slot 3 Type** to read the type of card recognised.

Value	Description	Type of card
0	None	-
772	RTE2	EXP-ETH2-IP-ADV200
255	Unknown	-

2. Start-up guide

This section provides a generic guide for setting up the module with a master/controller PLC. It covers the steps required to achieve cyclic data communication using the Industrial Ethernet protocol on the module.

2.1 Quick Guide

2.1.1 WEG EDS files

WEG provides an EXP-ETH2-IP-ADV200 device description file, which facilitates the configuration. The GSDML file contains information to identify the device, enter communication modules and transmit diagnostic information.

The files can be found in the folder:
C:\Program Files (x86)\WEG PC Tools\WEG_eXpress\Catalog\Drives\Inverter\ADV200\ADV200_7_x_yy\Service\EthernetIP.

For asynchronous motor applications use the file:
ADV200 V7.1 ETH2,eds.

For synchronous motors, use the file:
ADV200S V7.1 ETH2,eds.

In case of special support needs, please contact the WEG Customer Service: technohelp@weg.net

2.1.2 Fieldbus menu

To enable the EXP-ETH2-IP-ADV200 card, set the PAR 4000 Fieldbus Type parameter to "RTE".

In the CONFIGURATIONS menu under COMMUNICATION →CONF BUS FIELD, relating to the management of EXP-ETH2-IP-ADV200, the following parameters are available:

IPA	Parameter name	Value	Type
4000	Fieldbus type	Off	Enum
4010	Fieldbus M→S enable	Enable	Enum
4012	Fieldbus alarm mode	0	Int
4014*	Fieldbus state	Stop	Enum
4398	RTE Protocol	None	Enum
5608*	IP Address	0.0.0.0	UnsignedInt
5610*	Netmask	0.0.0.0	UnsignedInt
5612*	Gateway	0.0.0.0	UnsignedInt
5880	IP Address set	192.168.1.10	UnsignedInt
5882	Netmask set	255.255.255.0	UnsignedInt
5884	Gateway set	0.0.0.0	UnsignedInt
5886	Network set	Static	Enum

NOTE! All fieldbus settings and configurations only take effect the next time the drive is reset.

- **Fieldbus M→S Enable** = set to Disable the data that the PLC sends to the drive (master to slave) are no longer loaded from the drive and the current values are retained.
- **Fieldbus Alarm mode** (mode alarm) = if set to 1, the drive generates the errors BusLoss even if the drive is switched off.
- **Fieldbus state** = status of communication on the network:

PAR 4014 Fieldbus status	Industrial Ethernet
Stop	Booting
Init	Setting-up
Pre-operational	The EXP-ETH2-IP-ADV200 stays in this state until a Class 1 connection has been opened
Safe-op	Class 1 connection idle
Operational	Class 1 connections errors or Unexpected error

- **RTE Protocol** EthernetIP.
- **IP address set** Enter IP address of the network.
- **Netmask set** Enter IP address of the subnetwork.
- **Gateway set** Enter gateway IP address.
- **Network set** IP address assignment: DCHP = automatically assigned by the server; Static = uses the address configured with the above parameters.
- **IP address** Display the IP address in use.
- **Netmask** Displays the IP address of the subnetwork in use.
- **Gateway** Displays the IP address of the gateway in use.

2.1.3 Configuration of the EtherNet/IP module for cyclical communications

In the EtherNet/IP protocol configuration, the instances describing the data exchanged as I/Os have a fixed size that must match the settings made on the Master and the device.

The transmission speed of the network is fixed. The module must be associated with a IP address unique for the subnetwork in which it is used.

To check if the Ethernet cable connected to the EtherNet/IP module on the drive is correctly connected, look at the LED on the front of the module relating to the connector to be used: if it is green then there is a connection to the master, if it is off then check the wiring and verify that the master has started communication.

In the master, scan the network to check that the module is correctly connected to the master. If the network is correctly configured, one or more EtherNet/IP nodes will appear in the master PLC. Decide which input/output data you want to send cyclically (objects and/or parameters). The configuration of input/output data associated with cyclic data exchange polling can be done directly via drive parameters (settings of menu FIELDBUS M2S and FIELDBUS S2M).

It is important to set a data area size that is compatible between the master and the Ethernet/IP device bytes coincides with the size of the I/O area set on the master. The size in bytes occupied by the drive is obtained from the settings in the FIELDBUS M2S and S2M menus, by summing the size in bytes of each parameter set via the relative parameter "Fieldbus M→S n sys" or "Fieldbus S→M n sys", according to the following table:

Not assigned	The related data and all subsequent (even if assigned) do not contribute to the I/O area.
Count16,Par16,Fill16,MdpPlc16,Eu	2 bytes
Count32,Par32,Fill32,MdpPlc32,Eu float	4 bytes

The association between the I/O data area of the drive "Master to Slave (M2S)" and "Slave to Master (S2M)" and the assembly instance is as follows:

- M2S istanza assembly 100 Connection Output
- S2M istanza assembly 150 Connection Input

The size of the Connection Input on the master must always be increased by 4 bytes.

2.1.4 Downloading the configuration to the controller

After downloading the configuration to the controller, one or more LEDs on the front of the communication module flash according to the connected ports.

If the configuration is correct, when the state of the master switches to "Run" mode (on the drive, parameter 4014 "Fieldbus State" becomes "Operational"), the output values sent by the master are visible in the drive parameters associated with the channels configured in the "FIELDBUS M2S" menu, while the input values received are updated to the parameter values in the "FIELDBUS S2M" menu.

2.2 Configuration example of EtherNet/IP scanner

This paragraph contains an example of data exchange seen from the PLC side. This is the information normally dictated by the machine specification in the case of an application governed by EtherNet/IP scanners.

2.2.1 Communication description of input/output data cycling Master → Slave

The two parameters to be written via the process channels are the first one a command word (which we will call control word) in which the individual bits contain certain commands (e.g. enable, start); the second one the ramp reference 1 (RampRef1) in rpm.

Cyclic input/output data Industrial Ethernet: Master ⟶ Slave (max. 16 words)

Position	Description	Format	Measurement unit
Word1 M ⟶ S	Control word	16 bit Word	...
Word2 M ⟶ S	Ramp Ref 1	Int 16 bit	rpm
Word3 M ⟶ S			
Word4 M ⟶ S			
Word5 M ⟶ S			
Word6 M ⟶ S			
Word7 M ⟶ S			
...			
...			
Word16 M ⟶ S			

CONTROL WORD

Bit	Description	Notes
0	EnableCmd	Enable command from PLC
1	StartCmd	Start command from PLC
2	Free	
3	Free	
4	Free	
5	Free	
6	Free	
7	Free	
8	Digital Out3	PLC-controlled digital output 3
9	Digital Out4	PLC-controlled digital output 4
10	Free	
11	Free	
12	Free	
13	Free	
14	Free	
15	Free	

2.2.2 Communication description of input/output data cycling Slave → Master

The Ethernet/IP Scanner reads three parameters from the drive, the first one contains status word whose individual bits contain the drive status information (e.g. DriveOk); the second one is the current speed in rpm. The third parameter contains the value of the analogue input 2.

Cyclic input/output data Industrial Ethernet Slave ⟶ Master (max 16 Words)

Position	Description	Format	Measurement unit
Word1 S ⟶ M	Status Word	16 bit Word	BitWide
Word2 S ⟶ M	Actual Speed	Int 16 bit	rpm
Word3 S ⟶ M	Analog Input 2	Int 16 bit	
Word4 S ⟶ M			
Word5 S ⟶ M			
Word6 S ⟶ M			
Word7 S ⟶ M			
...			
...			
Word16 S ⟶ M			

STATUS WORD

Bit	Description	Notes
0	EnableState	Drive enabled
1	Drive Ok	Drive Ok
2	Speed is zero	Zero speed threshold
3	Free	
4	Free	
5	Free	
6	Free	
7	Free	
8	Digital Input 4	Digital input status 4 ADV200
9	Digital Input 5	Digital input status 5 ADV200
10	Free	
11	Free	
12	Free	
13	Free	
14	Free	
15	Free	

2.2.3 I/O composition procedure

Analysis of the size of the data in the composition instances shows that:

- Producing Data assembly instance 100, associated with 3 parameters in reading, consists of 6 bytes;
- Consuming Data assembly instance 150, associated with 2 parameters in writing consists of 4 bytes.

I/O data are thus associated in the instances.

Composition of assembly instance 100:

Instance Assembly	Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100	0	Low byte (4432 Word comp mon)							
	1	High byte (4432 Word comp mon)							
	2	Low byte (260 Motor Speed)							
	3	High byte (260 Motor Speed)							
	4	Low byte (1500 Analog input 1mon)							
	5	High byte (1500 Analog input 1mon)							
	6								
	7								
	...								
	31								

Composition of assembly instance 150:

Instance Assembly	Byte n.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
150	0	Low byte (4452 Word decomp src)							
	1	High byte (4452 Word decomp src)							
	2	Low byte (610 Ramp ref 1 src)							
	3	High byte (610 Ramp ref 1 src)							
	4								
	5								
	6								
	7								
	...								
	31								

2.3 ADV200 Programming

In the example given in this section, the first assumption is that the ADV200 drive parameters are the factory **default parameters**.

I/O data exchanged via the EXP-ETH2-IP-ADV200 can be configured and associated with drive parameters. Data written by the EtherNet/IP scanner to the drive are associated with Output Instance 150 and are configured on the drive via the "FIELDBUS M2S" (Master to Slave) menu parameters.

The data read from the scanner are associated with the Input instance 100 and are configured on the drive via the "FIELDBUS S2M" (Slave to Master) menu parameters.

A parameter can be either 2 or 4 bytes long, depending on the associated format, selected via the “Fieldbus M2S n sys” e “Fieldbus S2M n sys”.

16 input channels and 16 output channels are made available, in which a number of data between 0 and 16 may be allocated, as long as the total number of required bytes is not greater than 32 input bytes and 32 output bytes.

Example:

It is possible to have:
- 0 to 16 2-byte data
- 1 4-byte data + 0 to 14 2-byte data
- 2 4-byte data + 0 to 12 2-byte data
- ...
- 8 4-byte data

The data exchanged can be of two types:
- drive parameters;
- variables of an MDPlc application.

2.3.1 Reading states and writing commands to the drive

Specific parameters are made available for sending commands and reading drive status, where each bit is programmable and can be associated with a function.

Commands can be sent to the drive using the functions **Word decomp src** PAR 4452. The meaning of individual bits is programmable. It can be set on a fieldbus M→Sn channel as Count 16.

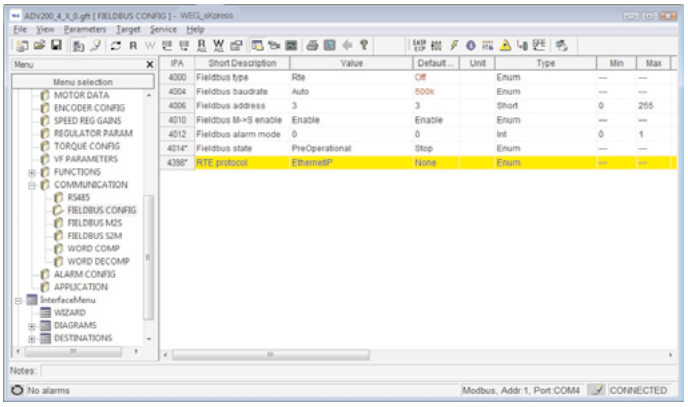
The drive status is read in **Word comp mon** PAR 4432, which can be programmed on any s→Mn channel of the fieldbus as Count 16. The meaning of each individual bit can be selected by the user using **Word bit0 src** of PAR 4400... **Word bit15 src** of PAR4430.

For a detailed description of these parameters, please refer to the drive manual.

FIELDBUS CONFIG menu

NOTE! All fieldbus settings and configurations only take effect the next time the drive is reset.

Program the fieldbus menu parameters as in the following figure:



I/O data exchange is only active when parameter 4014 "Fieldbus state" turns to the value "Operational". In all other cases, the scanner didn't I/O data exchange with the EXP-ETH2-IP-ADV200 card.

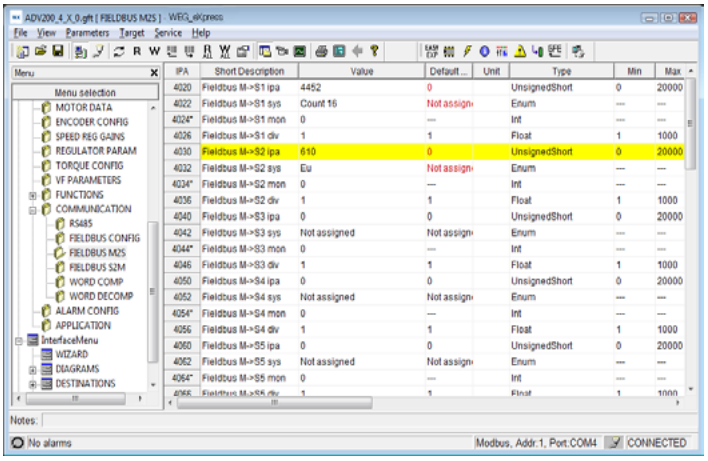
This could be related to problems in the configuration of the assembly instances, e.g. if the size set on the scanner does not match the size from the "FIELDBUS M2S" menu settings and "FIELDBUS S2M", or the scanner is not in 'Run' state.

However, when parameter 4014 "Fieldbus state" is "Operational", the I/O data is updated with the programmed parameter values. Only in this state the drive can be enabled.

2.3.2 Writing Output data

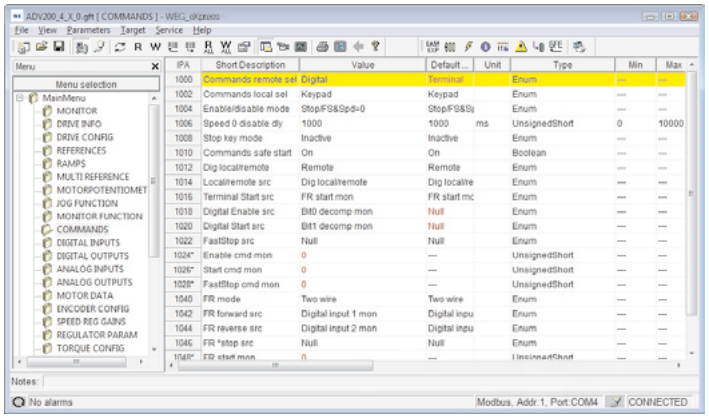
FIELDBUS M2S menu

The **control word** is configured using Wdecomp. The following figure shows the programming of Wdecomp on the first word M > S ("Export" mode):

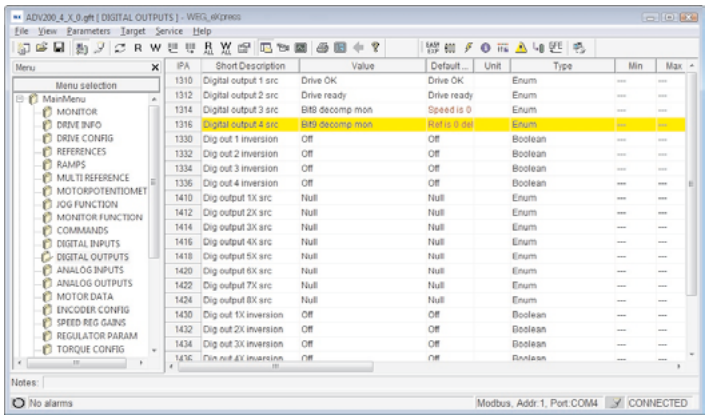


Now simply connect the individual bits of wdecomp. For commands, please note that as stated in the ADV200 manual, the drive must be in mode "**Remote**" and "**Digital**".

The programming of the first two bits takes place in the command menu as shown in the figure:

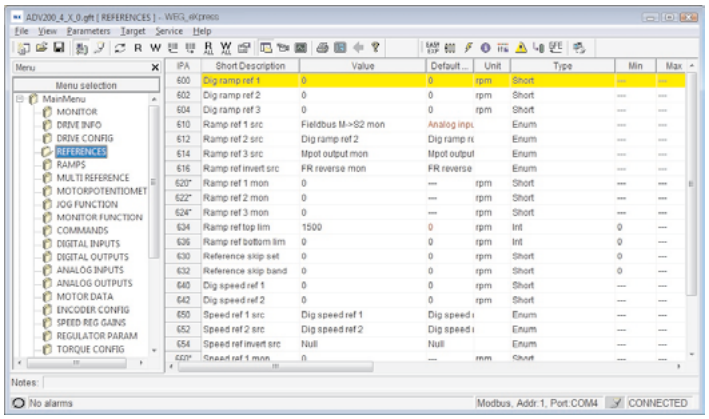


Bits 8 and 9 are programmed from the "Command word" as shown in the figure (Digital Outputs menu):

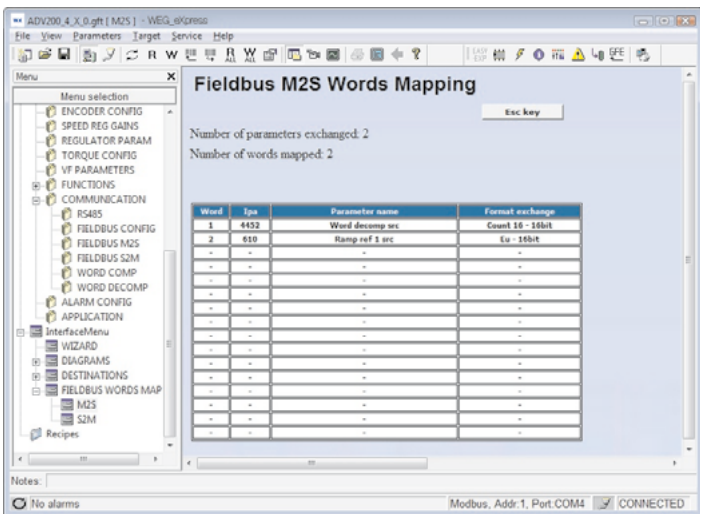


REFERENCES menu

The configuration of the second word is done in the REFERENCES menu:



After executing a save command and switching the drive back on, it is possible to check the correct configuration of the M→ S channels as in the figure (HTML page):

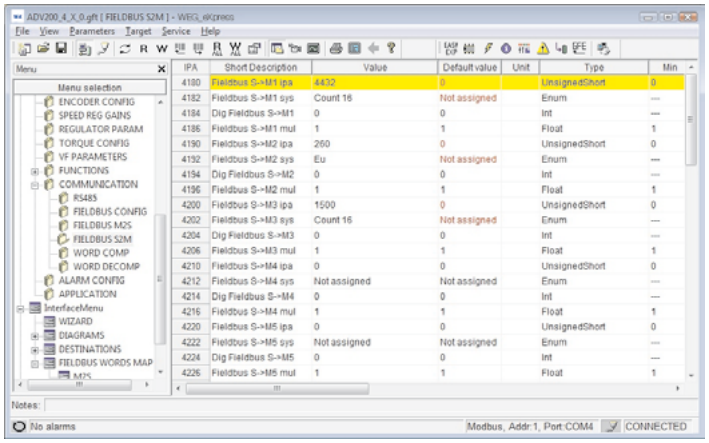


2.3.3 Writing Input data

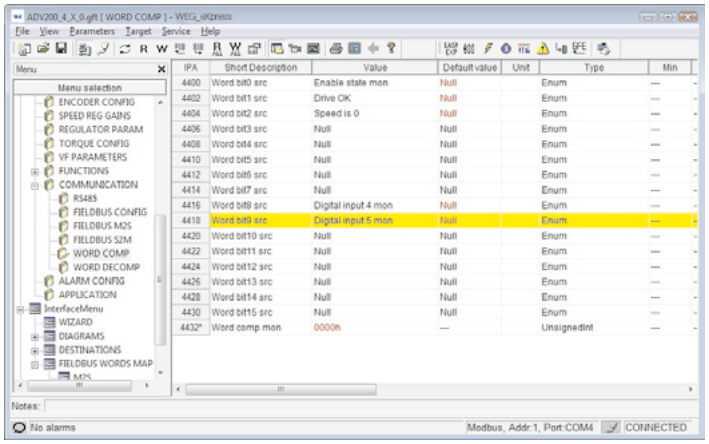
FIELDBUS S2M

The configuration of these channels is done in the FIELDBUS S2M menu. Wcomp used for programming the first channel.

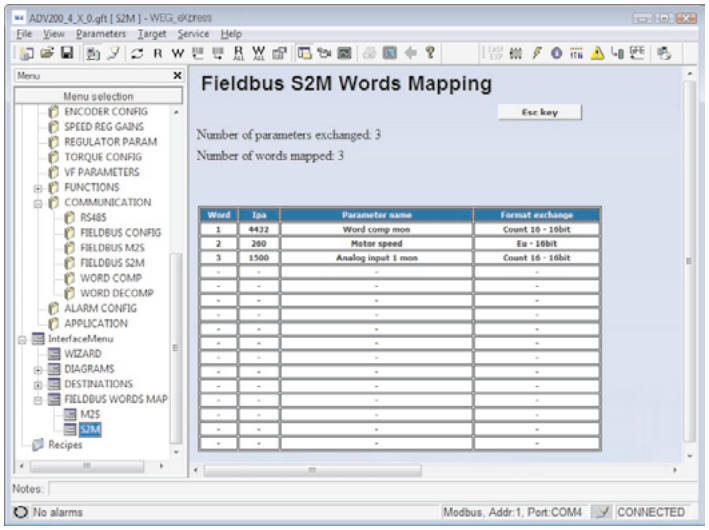
The following figure shows S2M programming:



The following figure shows the programming of Wcomp:



Similarly after a save and restart of the drive, it is possible to verify the correct programming of the channels Slave → Master:



2.3.4 Verification of the communication

The following are some notes/suggestions for verifying the communication.

- Cyclic input/output data communication is only active when parameter 4014 **Fieldbus state** is equal to "Operational". Check status via WEG_eXpress and expansion board LEDs.
- For Master → Slave communication in the FIELDBUS M2S menu, it is possible to check the value received by the communication channel (e.g. for the first channel is the parameter Fieldbus M→S1 Mon).
- In case of communication in EU (engineering units) remember that the value read on the Mon parameters of FIELDBUS M2S is in internal units (see conversion tables in chapter 5.0 SYSTEM INTERNAL VARIABLES, manual https://www.weg.net/catalog/weg/IT/en/p/MKT_WDC_GLOBAL_PRODUCT_INVERTER_ADV200).

3. Protocols

The EXP-ETH2-IP-ADV200 board works as a 'Generic Industrial Ethernet Device', which receives an implicit communication request from an EtherNet/IP scanner and consumes and produces data. It is also an 'explicit message server'. The following features are supported:

- Two EtherNet/IP ports
- 10/100 Mbit, full/half duplex operation
- (Device Level Ring) beacon-based DLR and linear network topology supported
- Data Transfer Layer, IEEE 802.3
- Identity object
- Message Router object
- Assembly object
- Connection Manager object
- DLR object
- ADI object (explicit message class for access to ADV200 parameters)
- TCP/IP Interface object
- Ethernet Link object

Network configuration via ADV200 parameters:

- IP address (default 192.168.1.10)
- Netmask (default 255.255.255.0)
- Gateway (default 0.0.0.0)
- Static/DHCP (default Static)

Management of Class 1 connection.

3.1 Connection details Class 1

3.1.1 Generalities

Class 1 connections are used to transfer I/O data and can be established with instances in the Assembly object.

Each Class 1 connection will establish two data transfers: one for consumption and the other for production. Heartbeat instances can be used for connections that only have access to inputs. Class 1 connections use UDP transfer. Null Forward Open function supported.

Total number of supported class 1 connections:	4
Max input connection size:	32 bytes
Max output connection size:	32 bytes
Supported RPI (Requested Packet Interval):	1... 3200ms
T→O Connection type:	Point-to-point, Multicast, Null
O→-T Connection type:	Point-to-point, Null
Supported trigger types:	Cyclic, CoS (Change of State)
Supported priorities:	Low, High, Scheduled, Urgent
T	Target, in this case the EXP-ETH2-IP-ADV200
O	Origin, in this case the EXP-ETH2-IP-ADV200

3.1.2 Types of connections

• Exclusive-Owner Connection

This connection type controls the outputs of the EXP-ETH2-IP-ADV200 card and does not depend on other connections.

Maximum number of Exclusive-Owner connections:	1
Connection point O →T:	Assembly Object, instance 96h (Default)
Connection point T →O:	Assembly Object, instance 64h (Default)

• Input-Only Connection

This type of connection is used to read data from the card EXP-ETH2-IP-ADV200 without output control. It does not depend on other connections.

Maximum number of Input-Only connections:	Up to 4 (Shared with Exclusive-Owner and Listen-Only connections)
Connection point O →T:	Assembly Object, instance 03h (Default)
Connection point T →O:	Assembly Object, instance 64h (Default)

Note that if an Exclusive-Owner connection is has been opened to the module and has expired, the Input-Only connection will also expire. If the Exclusive-Owner connection is properly closed, the Input-Only connection will be not affected.

• Extended Input-Only Connection

This connection functionality is similar to the standard Input-Only connection. However, when this connection expires, it does not affect the state of the application.

Connection point O →T:	Assembly Object, instance 06h (Default)
Connection point T →O:	Assembly Object, instance 64h (Default)

• Listen-Only Connection

In order to exist, this type of connection requires another connection. If this connection (Exclusive-Owner or Input-Only) is closed, the Listen-Only connection will be also closed.

Max. no. of Input-Only connections:	Up to 4 (Shared with Exclusive-Owner and Input-Only connections)
Connection point O →T:	Assembly Object, instance 04h (Default)
Connection point T →O:	Assembly Object, instance 64h (Default)

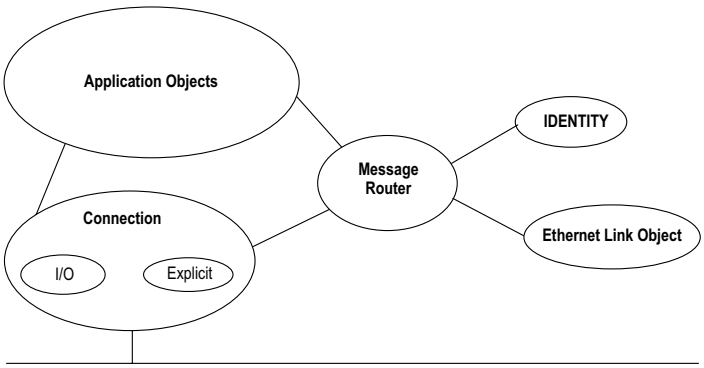
• Extended Listen-Only Connection

This connection functionality is similar to the standard Listen-Only connection. However, when this connection expires, it does not affect the status of the application.

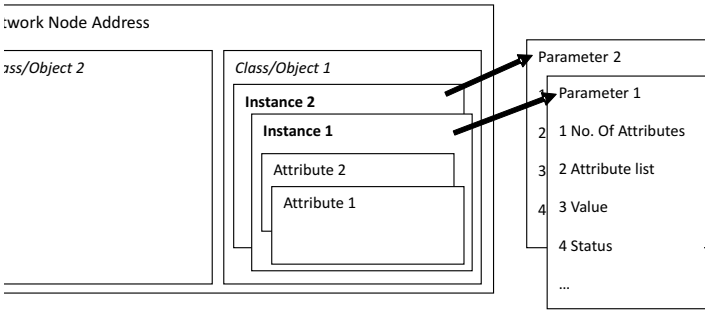
Connection point O →T:	Assembly Object, instance 07h (Default)
Connection point T →O:	Assembly Object, instance 64h (Default)

3.2 Description of data exchanged by RTE

The basic block diagram of the device can be represented as follows:



Addressing data within a CIP device uses an object-oriented view. A class (of objects) is a set of objects representing the same type of system component (see next figure). It is sometimes necessary to have more than one 'copy' of an object, called an object instance, within a device. This set of objects is called an 'object class'. Each instance of the object class will have the same set of attributes, but a unique set of values. An object instance or object class has attributes, which provide services and implement behaviour.



Access data within a device using a non-time critical message (explicit message) contains the following information: network address, class ID, instance ID, attribute ID, service code. This addressing is also used in electronic data sheets (EDS) to identify configurable parameters within a device.

In addition to specifying how device data is represented, the CIP also specifies methods by which I/O data can be accessed, using triggers, and how data from different objects can be combined in an I/O or configuration message using an Assembly object.

3.3 Description objects

Identity Object (0x01)

This object makes it possible to identify and retrieve general information from the device.

Class attribute

#	Name	Access	Type
1	Revision	Get	UINT
2	Max. instance	Get	UINT
3	Number of instances	Get	UINT

Attributes for the instance

#	Name	Access	Type
1	Vendor	Get	UINT
2	Device type	Get	UINT
3	Product code	Get	UINT
4	Revision	Get	Struct of USINT
5	Status	Get	WORD
6	Serial number	Get	UDINT
7	Product Name	Get	SHORT_STRING

Assembly Object (0x04)

Assembly instances allow input/output data to be linked to the communication connection.

Class attribute

#	Name	Access	Type
1	Revision	Get	UINT
2	Max. instance	Get	UINT

Attributes for instance 03h (Heartbeat, Input-Only)

This instance is used as Heartbeat for Input-Only connections. The data size of the instance in the Forward_Open-request is 0 bytes.

#	Name	Access	Type
3	Data	Get	N/A
4	Size	Get	UINT

Attributes for Instance 04h (Heartbeat, Listen-Only)

This instance is used as Heartbeat for Listen-Only connections. The data size of the instance in the Forward_Open-request is 0 bytes.

#	Name	Access	Type
3	Data	Get	N/A
4	Size	Get	UINT

Attributes for instance 06h (Heartbeat, Extended Input-Only)

This instance is used as Heartbeat for extended Input-Only connections and does not carry any attributes. The state of the connections established with this instance does not affect the state of the EXP-ETH2-IP-ADV200 card; in other words, if the connection expires, the module does not switch to the Error state. The data size of the instance in the Forward_Open-request is 0 bytes.

#	Name	Access	Type
3	Data	Get	N/A
4	Size	Get	UINT

Attributes for instance 07h (Heartbeat, Extended Listen-Only)

This instance is used as Heartbeat for extended Listen-Only connections and does not involve any attributes. The state of the connections established with this instance does not affect the state of the EXP-ETH2-IP-ADV200 card; in other words, if the connection expires, the module does not switch to the Error state. The data size of the instance in the Forward_Open-request is 0 bytes.

#	Name	Access	Type
3	Data	Set	N/A
4	Size	Get	UINT

Attributes for Instance 64h (Production Instance)

#	Name	Access	Type	Value/Description
3	Produced Data	Get	Array of BYTE	This data corresponds to the Write Process Data.
4	Size	Get	UINT	Number of bytes in attribute 3

Attributes for Instance 96h (Consumption Instance)

#	Name	Access	Type	Value/Description
3	Produced Data	Set	Array of BYTE	This data corresponds to the Read Process Data.
4	Size	Get	UINT	Number of bytes in attribute 3

ADI Object (0xA2h)

This object maps instances, corresponding to IPAs, onto EtherNet/IP. All requests addressed to this object will be converted into explicit object requests in the internal ADV200 database; the response will then be converted back into CIP format and sent to the sender of the request.

Class attribute

#	Name	Access	Type
1	Revision	Get	UINT
2	Max. instance	Get	UINT
3	Number of instances	Get	UINT

Attributes for the instance

Each instance corresponds to an IPA within the ADV200.

#	Name	Access	Type	Value/Description
1	Name	Get	SHORT_STRING	Parameter name (Including length)
2	Data type	Get	Array of USINT	Data type of instance value
3	No. of Elements	Get	USINT	Number of elements of the specified data type
4	Descriptor	Get	Array of USINT	Bit field describing the access rights for this instance Bit: Meaning: 1 1 = Get Access 2 1 = Set Access (reserved, set to 0) 3 1 = Write process data mapping possible 4 1 = Read process data mapping possible 5 1 = NVS parameter 6 1 = Data notification enabled
5	Value	Get	Determined by attributes #2, #3 and #9	Instance value

4. Alarms

In the event that the drive detects a problem related to EtherNet/IP communication, it can generate the 'Opt bus fault' alarm indicating the presence of an incorrect condition.

The 'Opt bus fault' alarm can be generated for a number of different causes:

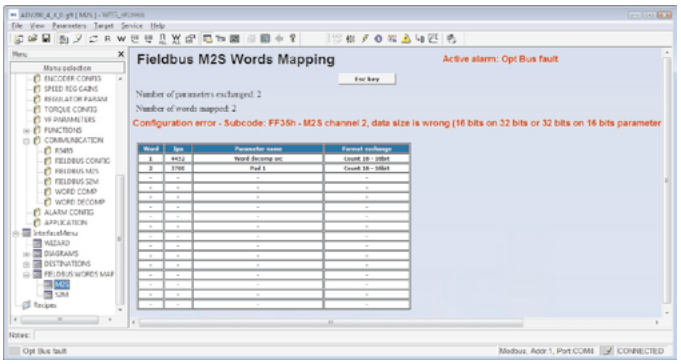
- **Configuration alarm.** Appears when the drive starts up (you must press Esc to continue: Ethernet/IP communication will not be available). Indicates an unrecoverable problem in the drive configuration or in the EXP-ETH2-IP-ADV200 card. Check the settings in the 'Fieldbus', 'Fieldbus M2S' and 'Fieldbus S2M' menus. The Alarm Subcode provides an indication of the cause of the problem.
- **Hardware alarm.** Non-recoverable problem on the EXP-ETH2-IP-ADV200 card, occurring after start-up and during normal operation. If it occurs again, the card may need to be replaced.
- **Bus loss alarm, with SubCode = 0.** Indicates loss of communication (change from Run to Off network status) when the drive is enabled, or parameter 4012 = 1. Data exchange must be active (4014 = Operational) when the drive is enabled.

Subcode	Description	Notes
0	Bus loss	Loss of connection to the scanner or Industrial Ethernet status no longer operational
0x8101	System error	If not recoverable, replace module
0x8102,0x8104	DPRAM Error, after WarmStart	If not recoverable, replace module
0x8110	Not Ready timeout, NetX not available	If not recoverable, replace module
0xFF02	Communication with module not available	DPRAM not recognised. Replace module
0xFF04	Module software version not compatible	
FF01	Fieldbus type not suitable for expansion card	Check if EXP-ETH2-IP-ADV200 card is installed correctly
FF14..FF23	Object selected not valid for mapping to Channel M2S n	Check 'Fieldbus M→Dest Sn'
FF24..FF33	More than 1 Src points to Channel M2S n	Check multiple destinations on 'Fieldbus M→Dest Sn'
FF34..FF43	Channel M2S n, invalid data size (16 bit on 32 bit parameter or 32 bit on 16 bit parameter)	Check 'Fieldbus M→Sn sys'
FF44..FF53	Invalid parameter on Channel S2M	Check 'Fieldbus S→Mn src'
FF54..FF63	Channel M2S n, invalid data size (16 bit on 32 bit parameter or 32 bit on 16 bit parameter)	Check 'Fieldbus S→Mn sys'
FF64..FF73	Selected object invalid for mapping on Channel S2M n	Check 'Fieldbus S→Mn src'
FF74..FF83	M2S Channel n: too many words in PDC	Address 'Fieldbus M→Sn Dest' and address 'Fieldbus M→Sn sys' greater than 16 words in PDC
FF84..FF93	S2M Channel n: too many words in PDC	Address 'Fieldbus S→Mn src' Address 'Fieldbus S→Mn sys' greater than 16 words in PDC
FFB4..FFC3	Internal database error on Channel n	Internal error, contact manufacturer

Parameter 4670 'Optionbus activity' can be used to set the action to be taken by the drive in the event of a loss of communication condition.

The default setting is 'Disable' and indicates that the drive should be disabled. It is possible to choose 'Warning' to allow the drive to continue to operate, while displaying the presence of the error. See the drive manual for more details.

WEG_eXpress can be used to obtain a description of the cause of the 'Opt bus fault' alarm by connecting to the relevant HTML page as shown in the following figure:



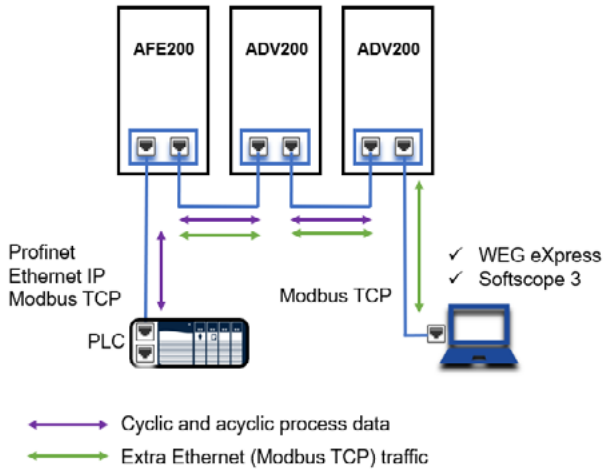
5. Drive configuration in Modbus-TCP

The board provides the ability to configure the drive via a Modbus-TCP communication overlay with the dedicated Ethernet network for fieldbus communication. WEG_eXpress and WEG_softscope3 tools are used to configure and monitor the drive.

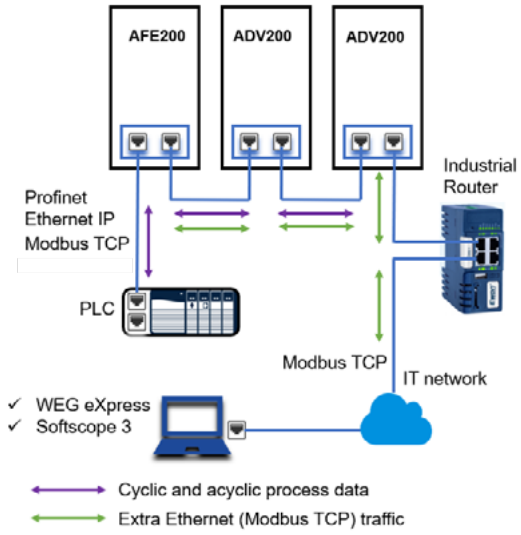
6. Connection type

It is possible to make a Peer to Peer connection and/or a remote connection.

In the first case (peer to peer), the connection is made with a local PC connected to the communication network as shown in the figure.



In the second use case (remote), the Industrial Ethernet network and the IT network must be appropriately configured to avoid excessive overlapping of data exchange.
To manage the connection between different networks, it is mandatory to use industrial routers that allow the partialisation of data exchange based for example on router technology (natting tables).
Access and communication security must be guaranteed by specific firewall-router protections.



7. WEG_eXpress

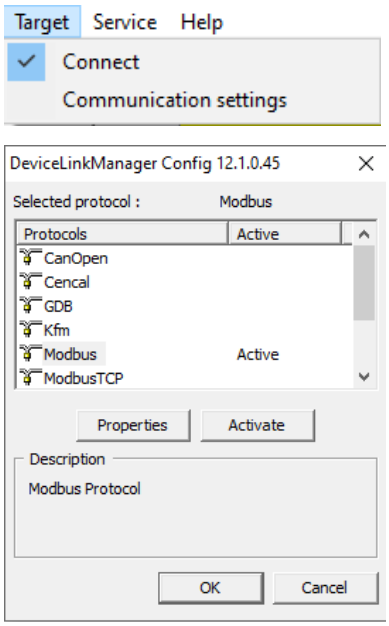
To configure the device parameters from WEG_eXpress, the functionality must be enabled within the communication tool with TCP/IP.

Procedure:

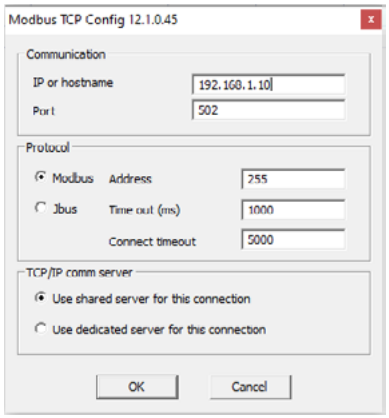
1. Open the WEG_eXpress tool and select DRIVES, then select INVERTER and choose the ADV200 family drive from the drop-down menu:

2. Click on Manual to set manual configuration (automatic mode is not available);
3. Select the FW of the connected drive (click on **Select** version). In the case of connection via Modbus RTU, set the communication data and press **Select**. In the case of connection via Modbus-CP, deselect 'Online mode' and follow the next steps.

4. To enable communication with TCP / IP open the drop-down menu **Target / Communication settings** and select **ModbusTCP**:



5. Click on Activate and then Properties, a window opens where the IP address and Modbus address of the connected device can be set.
   The address is the same as the one assigned for Ethernet IP communication. The same procedure can also be applied to Softscope 3.
   Press OK.



8. References

- PUB00213R0 “EtherNet/IP_Developers_Guide” Quick Start for Vendors Handbook
- ADV200 ‘Quick Start Guide - Specification and Installation’ Handbook
- ADV200 Handbook with ‘Description of Functions and Parameters’ list

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