Installation, Operation and Maintenance Manual
MDE 256 Rev. 2
October 2022

Biffi ICON3000

PROFIBUS DPV2 Slave Redundancy Module

BIFFI

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Table of Contents

Section 10: Data Exchange Mode (Cyclic Communication)

Section 11: Diagnosis - Alarms

Appendix A: Diagnosis: Card Information from PLC

Appendix B: References

Section 1: Introduction

The PRO2000v4_RED is an electronic card that allows connecting the Biffi electrical actuator ICON3000 actuators to a PROFIBUS DP network. The card has its microprocessor and a program stored internally. It works as a pure bus interface and does not affect the actuator control integrity. It is installed inside the actuator housing and takes the electrical power from the actuator power supply card. The RS485 interface is located on the card board. The PROFIBUS network is fully isolated from the actuator electronics.

The PRO2000v4_RED is designed to support PROFIBUS redundant communication as per Slave Redundancy Specification PNO Order No: 2.212.

The PRO2000v4_RED module can also be installed in the ICON3000v2 actuator. The ICON3000v2 actuator can be recognized because when it is switched on, the name “ICON3000v2” appears on the local screen, as shown in Figure 1.

Figure 1

Section 2: Operation and Storage

The card is designed to work and to be stored in the same environment of the actuator.

Section 3: PRO2000V4_RED Implementation

The card consists in a single PCB that is installed inside the actuator housing. It is connected to the ICON3000 actuators base card via strip connector.

The internal wiring connects the PROFIBUS data lines to the actuator terminal board.

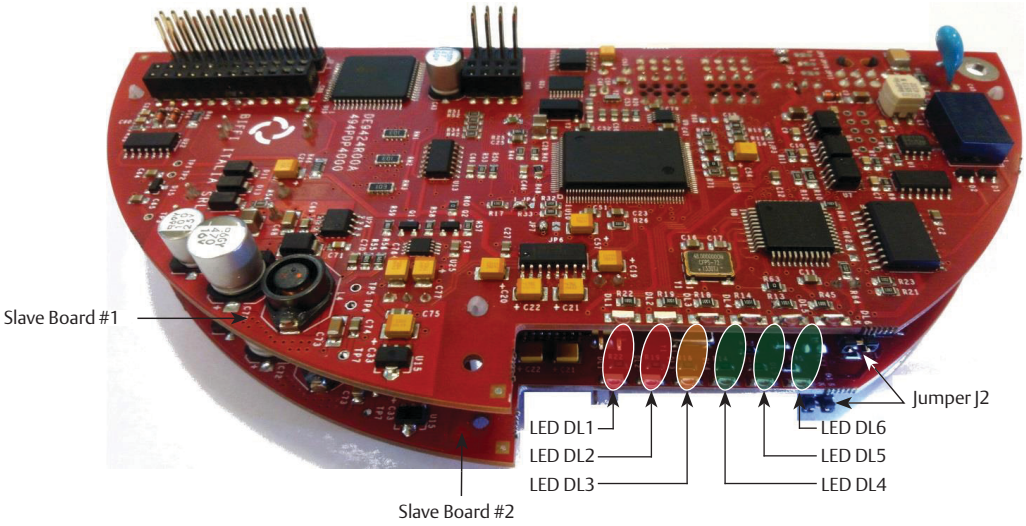
The PRO2000v4_RED module is implemented with two different electronic boards suitable to be installed either in the ICON3000 or in ICON3000v2 actuators.

3.1 Communication Features

Communication protocol	: PROFIBUS DP according to EN 50170							
Network topology	: Line (bus) structure. With repeaters, tree structures can also be realized							
Transmission medium	: Twisted, screened copper cable according to EN 50170							
Data rate	: 9.6	19.2	45.45	93.75	187.5	500	1500	Kbit/s
Cable length without repeater	: 1,200	1,200	1,200	1,200	1,000	400	200	m
Station type	: DPV1 and DPV2 (redundancy) slave							
Device number	: 32 devices per segment without repeater (max 126, with repeaters)							
Bus access	: Token-passing between masters and polling for slaves							
Electrical power	: Actuator powered (as option: auxiliary external voltage supply)							
Bus termination	: Configurable on board via local operator interface of actuator							
Temperature	: -40 °C, +85 °C							
Fieldbus redundancy	: Two independent communication interfaces							
Types of operation	: Cyclic data exchange, Sync mode, Freeze mode, Fail-safe mode							
Baud rate	: Automatic recognition							
Addressing	: Configurable via local operator interface							

3.2 On Board Indication for ICON3000 Actuator

Figure 2 PRO2000v4_RED Module for ICON3000 Actuator



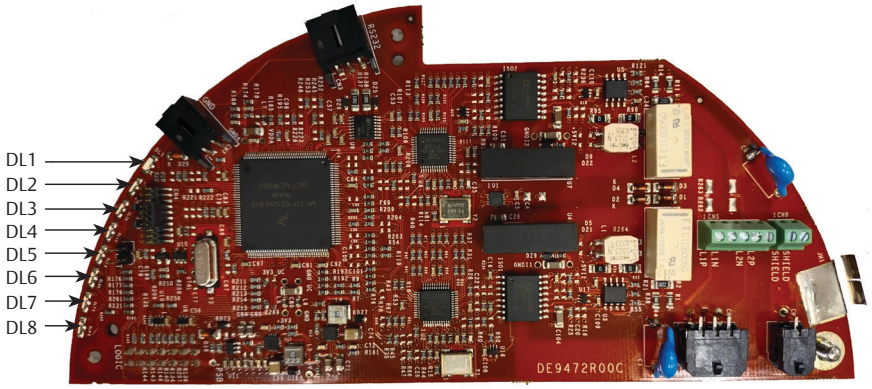
Five LEDs are mounted on the PRO2000v4_RED to give the following indications for Field service. LEDs indications are active only when jumper JP2 is closed.

DL1 (Red) Data Area Empty:	ON when Data Area on interface card is not yet loaded. BLINK when Data Area is being read from base card. OFF when Data Area is completely loaded.
DL2 (Red) Base comm:	ON when the communication between the base card and the interface is not working properly. OFF when the communication between the base card and the interface is correct.
DL3 (Orange) Slave State:	ON when the interface acts as an Primary Slave (i.e. it is the interface with a valid communication with the Master). BLINK when the interface acts as a Backup Slave and it is ready (only for redundant configuration). OFF when the interface is not communicating with any Master.
DL4 (Green) Termination:	ON when the on bard PROFIBUS termination has been inserted. OFF when the on bard PROFIBUS termination has not been inserted.
DL5 (Green) PROFIBUS:	ON when PROFIBUS communication has been established and the interface has entered in DATA_EX state.
DL6 (Green) Power:	ON when the interface is correctly powered.

More indications are given on local operator interface as described in Section 9.2, Node Report.

3.3 On Board Indication for ICON3000v2 Actuator

Figure 3 PRO2000v4_RED Module for ICON3000v2 Actuator



Eight LEDs are mounted on the PRO2000v4_RED to give the following indications for Field service.

DL1 (Red) Alarm Active:	ON when the interface detects one or more hardware issue. OFF when the interface can work correctly.
DL2 (Orange) Slave State Primary:	ON when the IM1 interface module acts as Primary Slave (i.e. it is the interface with a valid communication with the Master). BLINK when the IM1 interface module acts as a Backup Slave and it is ready. OFF when the IM1 interface module is not communicating with any Master.
DL3 (Green) Slave State:	BLINK when the interface communicates with base card. Fixed ON or OFF when the communication between base card and interface is locked.
DL4 (Green) PROFIBUS:	ON when PROFIBUS communication of IM1 has been established and the interface has entered in DATA_EX state.
DL5 (Orange) Slave State Primary:	ON when the IM2 interface module acts as Primary Slave (i.e. it is the interface with a valid communication with the Master). BLINK when the IM2 interface module acts as a Backup Slave and it is ready. OFF when the IM2 interface module is not communicating with any Master.
DL6 (Green) Application running:	BLINK when the interface application is running correctly. Fixed ON or OFF when the application is not running correctly.
DL7 (Green) PROFIBUS:	ON when PROFIBUS communication of IM2 has been established and the interface has entered in DATA_EX state.
DL8 (Green) Power On:	ON when interface module is correctly powered from base card.

More indications are given on local operator interface as described in Section 9.2, Node Report.

Section 4: PROFIBUS DP Description

PROFIBUS is a vendor-independent, open field bus standard used in a wide range of application in process automation. Vendor independence and openness are ensured by the international standards EN 50170 and EN 50254. The DP communication profile is designed for data exchange at the field level. The central controllers (as PLC) communicate via serial connection with field devices (as sensors and actuators). Data exchange is mainly cyclic. The central controller (called Master) cyclically reads the input information from the field devices (called Slaves) and cyclically writes the output information to the slaves. In addition, PROFIBUS DP provides communication services for parameterization, alarm handling, and monitoring of intelligent field devices. The maximum number of Master and Slave devices in a bus segment is 32 without repeaters. With repeaters, the number can be extended to 126. The maximum cable length depends on the speed of transmission. Higher is the speed shorter is the length. For instance, with baud rate 93.75 Kb/s, the maximum cable length is 1,200 m without repeaters.

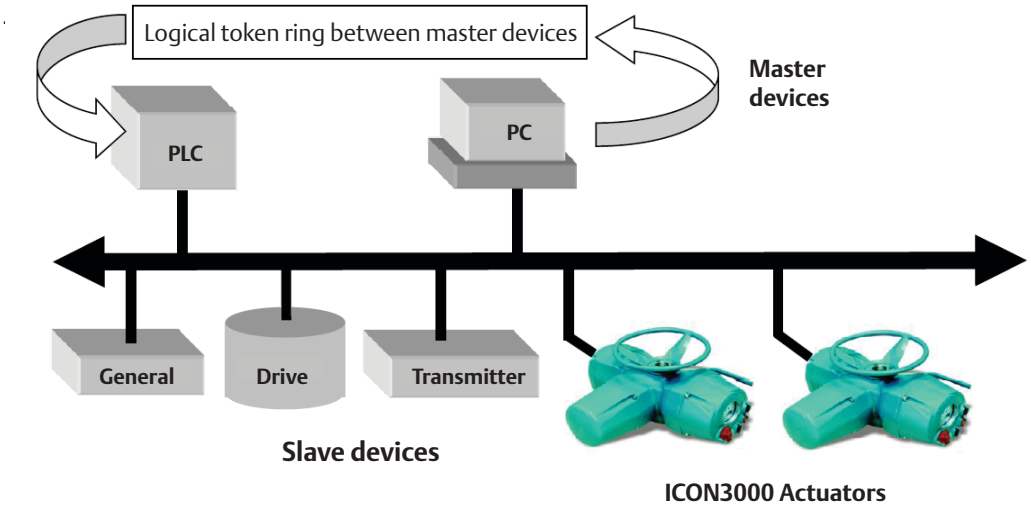
Mono-master or multi-master system configuration can be provided. Bus access is controlled by token passing procedure between masters and master-slave procedure (polling) between master and slaves.

Types of devices:

DP Master Class 1 (DPM 1):	This is the central controller that cyclically exchange information with the field devices. Typical devices are PLC or PC.
DP Master Class 2 (DPM 2):	These devices are necessary for commissioning, maintenance and diagnostics.
Slave:	Field device such transmitters, actuators, drives, etc.

Figure 4 shows a PROFIBUS DP configuration with two Master devices and different Slave devices.

Figure 4



4.1 RS485 Transmission Mode

The PRO2000v4_RED module uses a half-duplex, multidrop, serial communication line RS485. The card communicates with the Masters via its RS485 interface and the transmission media consists in a shielded twisted pair cable. Transmission speed from 9.6 kbit/s to 1.5 Mbit/s are available. One unique transmission speed is allowed for all devices on the bus when the system works.

All devices are connected in a bus structure. Up to 32 station (Master and Slaves) can be connected in one segment without repeaters. Repeaters can be used to extend the number of device up to 126 and to enlarge the network area. Table 1 shows the relationship between baud rate and segment length.

Table 1.

Baud Rate	Maximum Segment Length (no repeater)
9.6 K	1,200 m
19.2 K	1,200 m
45.45 K	1,200 m
93.75 K	1,000 m
187.5 K	1,000 m
500 K	400 m
1500 K	200 m

The bus must be terminated by an active bus terminator at the beginning and at the end of each segment. Only two terminations in one bus segment must be provided. To ensure error-free operation, both bus terminators must be powered. The maximum cable length depends on the transmission speed. Cable lengths indicated in Table 1 are based on type A cable, as specified by the EN 50170, having the following characteristics:

- Impedance from 135 to 165 ohm
- Capacity < 30 pF/m
- Loop resistance 110 ohm/km
- Wire gauge 0.64 mm
- Conductor area > 0.34 mm^2

The use of cable of previously used type B is not recommended.

The data lines must not be reversed. Use of shielded cable is mandatory for having high system immunity against electromagnetic disturbs. The shield should be connected to ground on both sides. The data lines should be kept separate from all other cables. It should be laid in separate, conductive and earthed cable trunking. It must be ensured that there are not voltage differences between individual nodes of PROFIBUS DP.

Figure 5

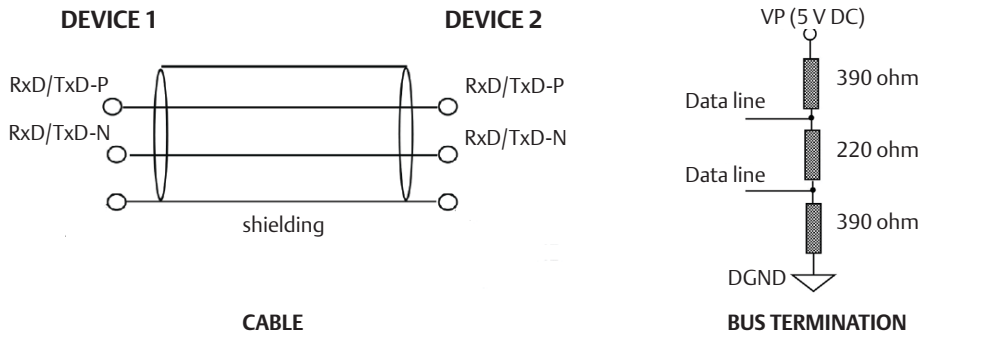
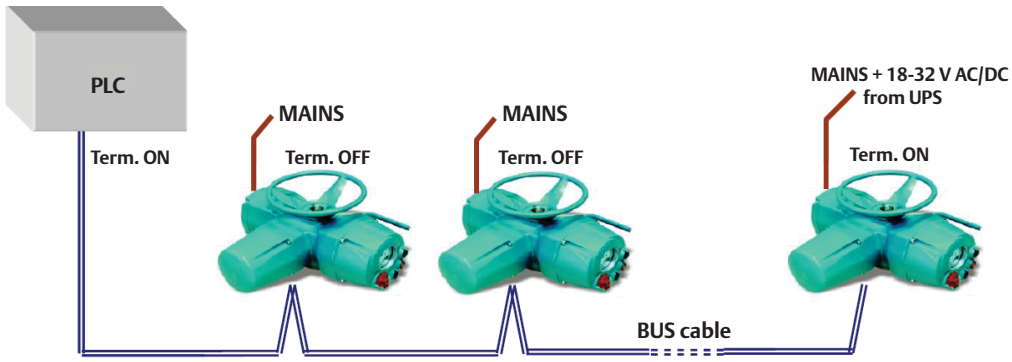


Figure 6 shows the bus with an actuator at the end of the bus segment. To be sure that the terminations are supplied also if the mains fails, an auxiliary voltage supply generated by an UPS is connected to the actuator to supply the electronics and the termination.

Figure 6



Section 5: PRO2000V4_RED Power-Up

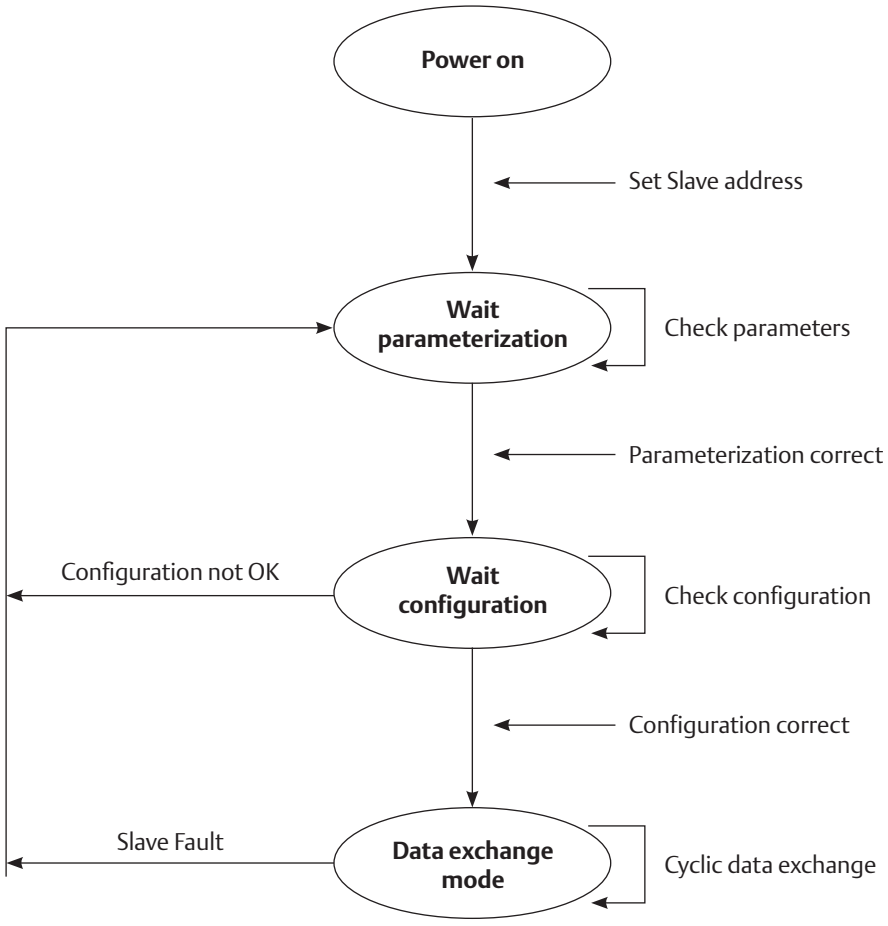
On power-up the card checks the baud rate and then it waits for the “parameterization” telegram from the Master. The parameterization message contains user information needed for actuator operation and listed in the Section 10: Data Exchange Mode (Cyclic Communication).

After that the card waits for the “configuration” telegram from Master. The configuration message contains the number of input and output bytes reserved in the memory of the Master device for each slave. Only the number of bytes determined in the configuration is transmitted between Master and Slave. This information is called “module”.

When parameters and configuration are correct, the module enters in “Data exchange mode” and starts with normal operation. The Master cyclically sends commands to the Slave and read its status.

Figure 7 shows the state machine of a DP slave.

Figure 7



Section 6: Slave Redundancy (DPV2)

The PRO2000v4_RED is designed to allow the actuator to act as a redundant slave in accordance to PNO Order No: 2.212.

A slave redundancy architecture has high reliability thanks to important features:

- No loss of data during fault
- Short switch over time

A redundant slave foreseen two PROFIBUS communication interfaces with special redundancy extensions and a redundancy communication channel.

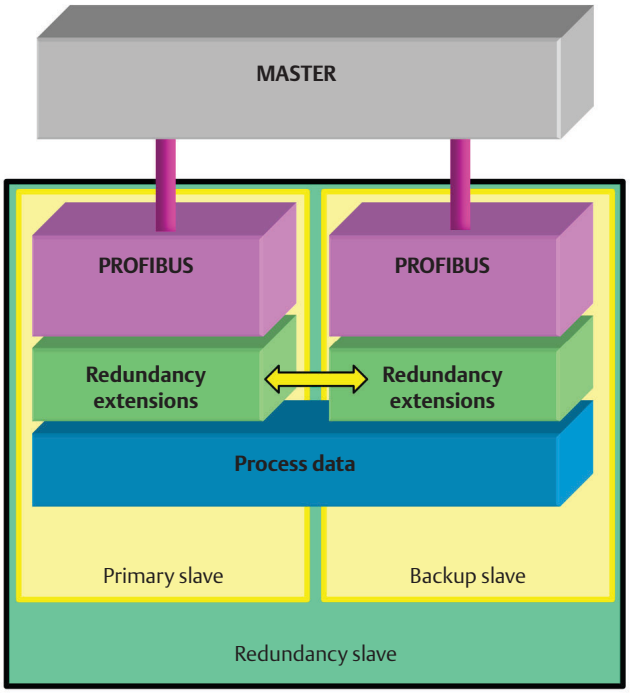
A redundant slave must foresee:

- At least 2 PROFIBUS connections
- 2 independent PROFIBUS communication interfaces
- A redundancy communication channel (RedCom)

The RedCom provide a PROFIBUS independent communication between the two slave interface cards. The RedCom channel performance capability influences the total switch over time of the redundant slave.

Figure 8 shows an overview of the system architecture.

Figure 8



The PROFIBUS DP communication with a redundant slave will be done in the following way:

- MS0 (cyclic): The primary slave uses the cyclic communication to send and receive the process values. In addition, the primary slave sends all diagnosis information about itself and the backup slave.

  The backup slave also sends and receives data with the MS0 services, but these data is not relevant and shall be ignored by the backup slave and the master.
- MS1 (acyclic): Only the primary slave receives and transmits MS1 services.
  When the backup slave receives a MS1 service, it responds negative.
- MS2 (acyclic): Both the primary and the backup slave receive acyclic MS2 services.
  Both slave interface cards process these services to allow an individual communication with the specific device.

At the start up (and every time it is necessary), the Master sends the PRM commands to two slave interface cards in order to determine which is the Primary and the Backup.

The Primary slave sends the complete diagnosis information of the Redundant slave.

The monitoring of the PROFIBUS communication ability of the Redundant slave is done by the redundancy of the master with standard PROFIBUS mechanisms. Therefore, also all communication parts of the Backup slave shall be fully operable. They shall be connected to the bus, the driver shall be enabled, and the PROFIBUS ASIC is initialized and running.

If the master redundancy detects a communication failure to the Primary slave, it will issue a command to the Redundant slave to inform it about that fact. The Redundant slave performs a redundancy switchover.

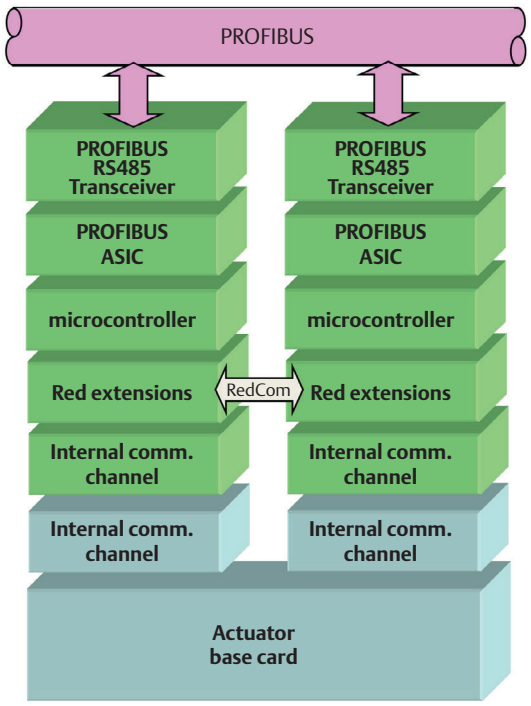
The monitoring of the PROFIBUS communication by the master will work also for a single line failure. That means, when only the receive-line or the transmit-line of the Primary slave has a failure, the Master will also detect this and the command will be sent to the Redundant slave.

One of the key features of the Slave redundancy is that the process input and output signals are stable during a redundancy switchover. From the process point of view, a redundancy switchover is invisible.

The master or the master application is responsible to keep the input signals of a Redundant slave stable during the switchover.

The hardware implementation of the Slave Redundancy for the PRO2000v4_RED is shown in Figure 9.

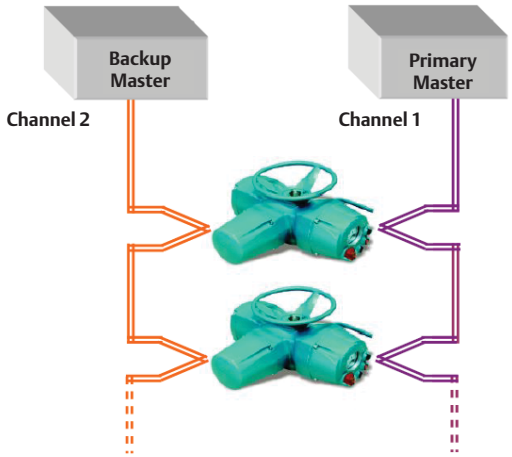
Figure 9



6.1 Redundancy Structures

The Slave redundancy specification (Order No. 2.212) foreseen two different type of redundancy architectures: the System redundancy and the Flying redundancy.

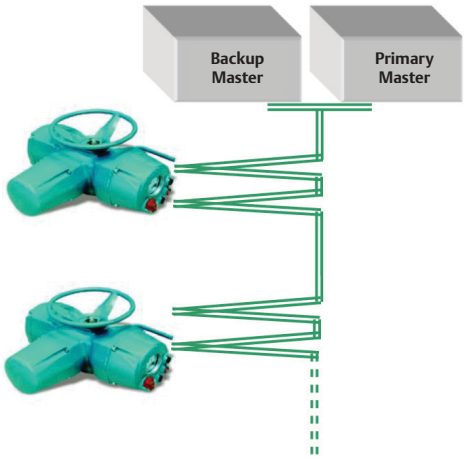
Figure 10 System Redundancy



In the System redundancy layout, the two interfaces may have the same address because the two interfaces are on different channels.

A synchronization method must be active between the Master stations to take the information from the Primary Slave.

Figure 11 Flying redundancy



In the Flying redundancy layout, the two interfaces shall have different addresses because the two interfaces are on the same channel.

The backup address shall be PRIMARY ADDRESS+64.

Section 7: Wiring: Bus Terminations

The very flexible strategy implemented in the PRO2000v4_RED card allows also different layout that the Master station can drive.

The bus terminations can be switched on each data lines by means of two links, configurable via local operator interface.

The PRO2000v4_RED card takes its electrical supply from the actuator power supply card.
The RS485 bus transceiver is isolated from the actuator electronics. Also, the voltage supply of the bus termination is isolated. The PRO2000v4_RED card is equipped with on-board bus termination that should be used when the actuator is at the beginning or at the end of the bus segment and if there is no external termination. The bus termination can be switched on the data lines by means of a link, configurable via local operator interface.

Since the bus termination is a crucial component to ensure error-free operation, it is important that termination remains powered also when the actuator supply has left. If the internal termination is used, it is suggested to connect to the actuator also an auxiliary 18 V AC/36 V DC generated by safe source that will supply just the actuator electronics and the PROFIBUS termination.

Hence, in order to avoid PROFIBUS connection loss if the actuator is switched off it must be present an internal DC/DC converter option not included in the normal supply for the actuator, to be specified upon purchase order.

7.1 Redundant Channel

Figures 12 and 13 shows the wiring necessary in case single channel zero stub slave. The termination must be linked to the data lines only if the actuator is at the beginning or at the end of the bus segment.

The redundant channel feature (DPV2 PNO SPEC 2.212) must be requested when ordering the actuator.

Figure 12 Wiring connection for ICON3000/ICON2000v4 and F01 actuator

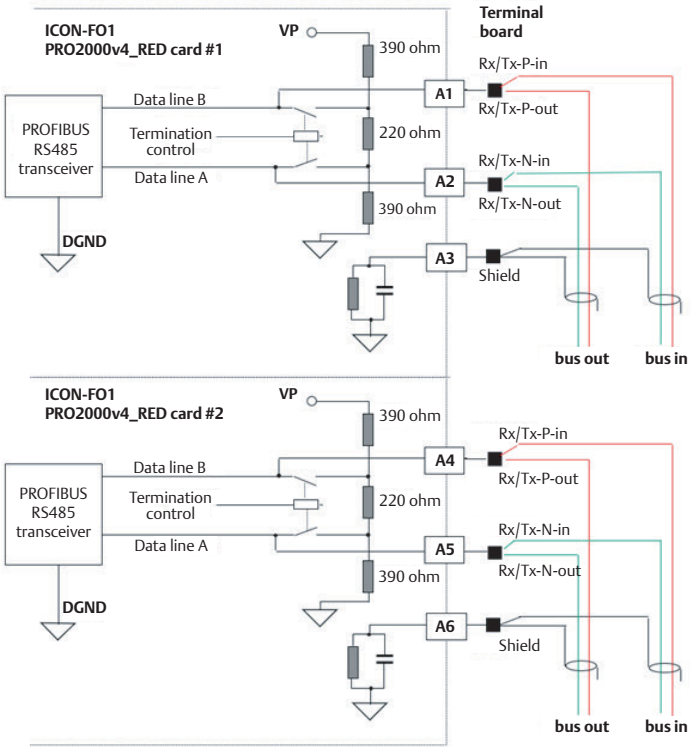
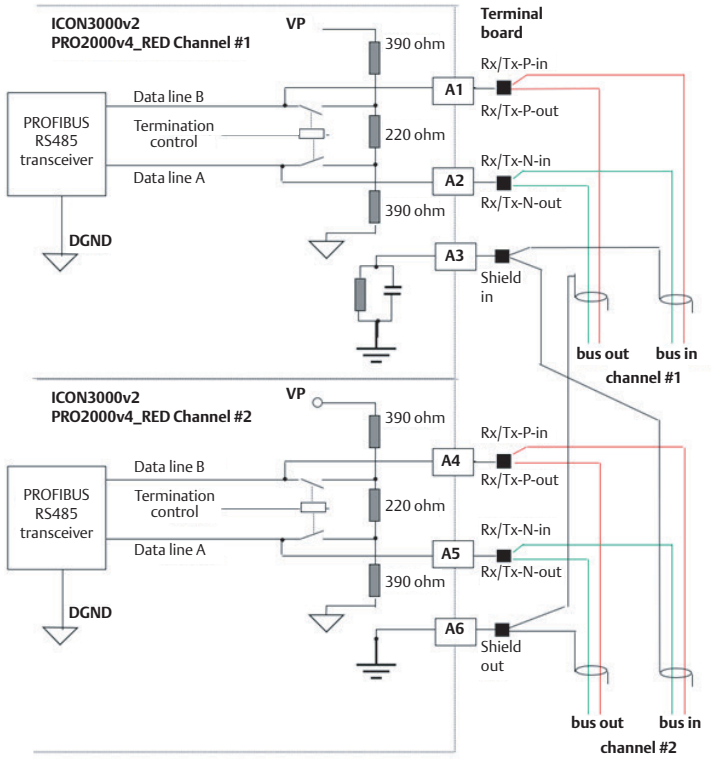


Figure 13 Wiring connection for ICON3000v2 actuator



7.2 Single Channel

Figures 14 and 15 shows the wiring necessary in case single channel slave. The termination must be linked to the data lines only if the actuator is at the beginning or at the end of the bus segment.

Figure 14 Wiring connection for ICON3000/ICON2000v4 and F01 actuator

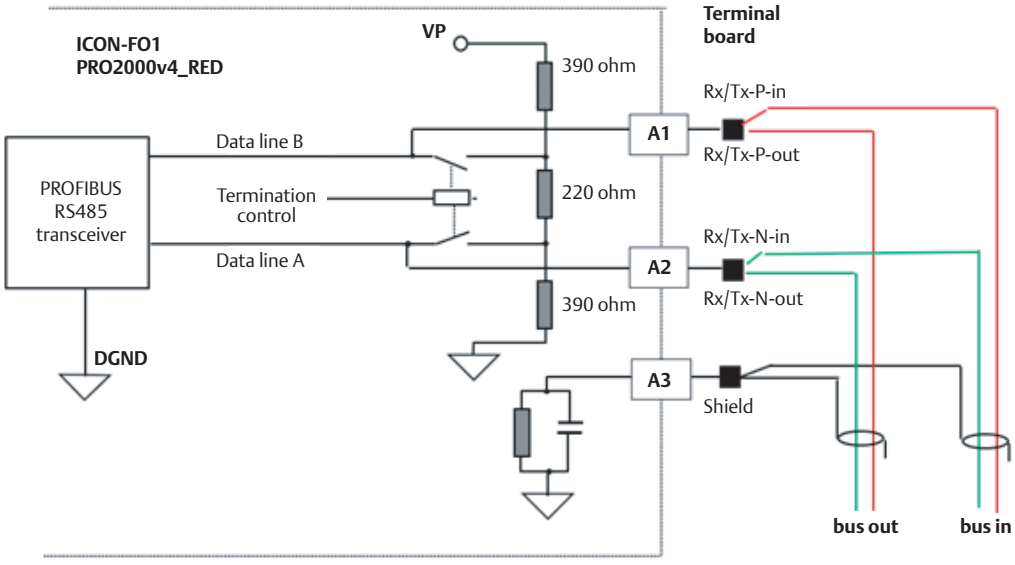
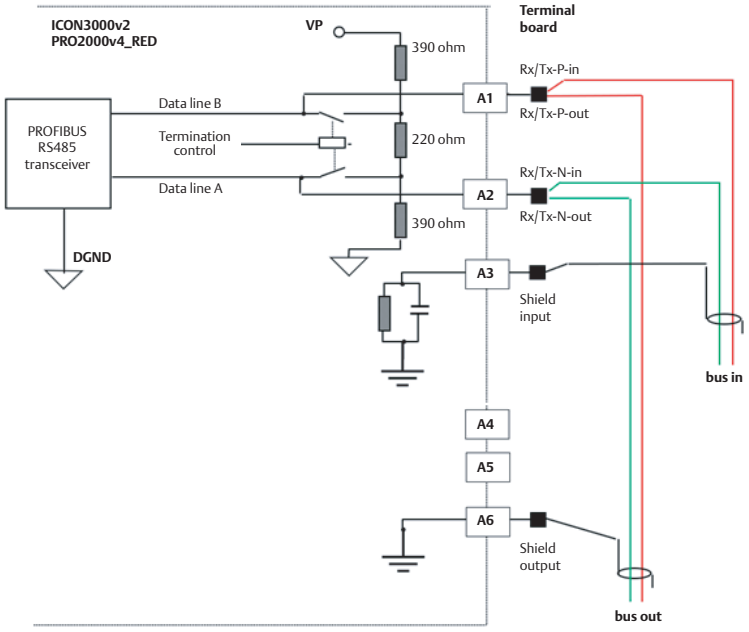


Figure 15 Wiring connection for ICON3000v2 actuator



7.3 Single Channel Zero Stub

Figures 16 and 17 shows the wiring necessary in case single channel zero stub slave. The termination must be linked to the data lines only if the actuator is at the beginning or at the end of the bus segment.

The single slave “zero stub” feature must be requested when ordering the actuator.

Figure 16 Wiring connection for ICON3000/ICON2000v4 and F01 actuator

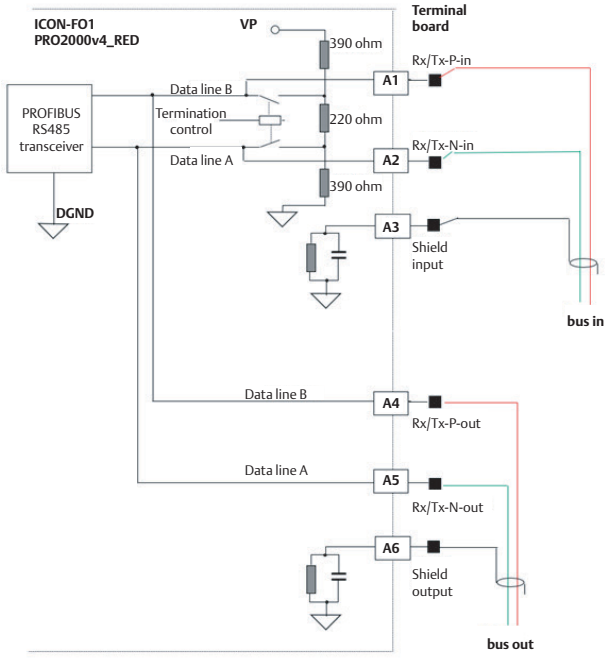
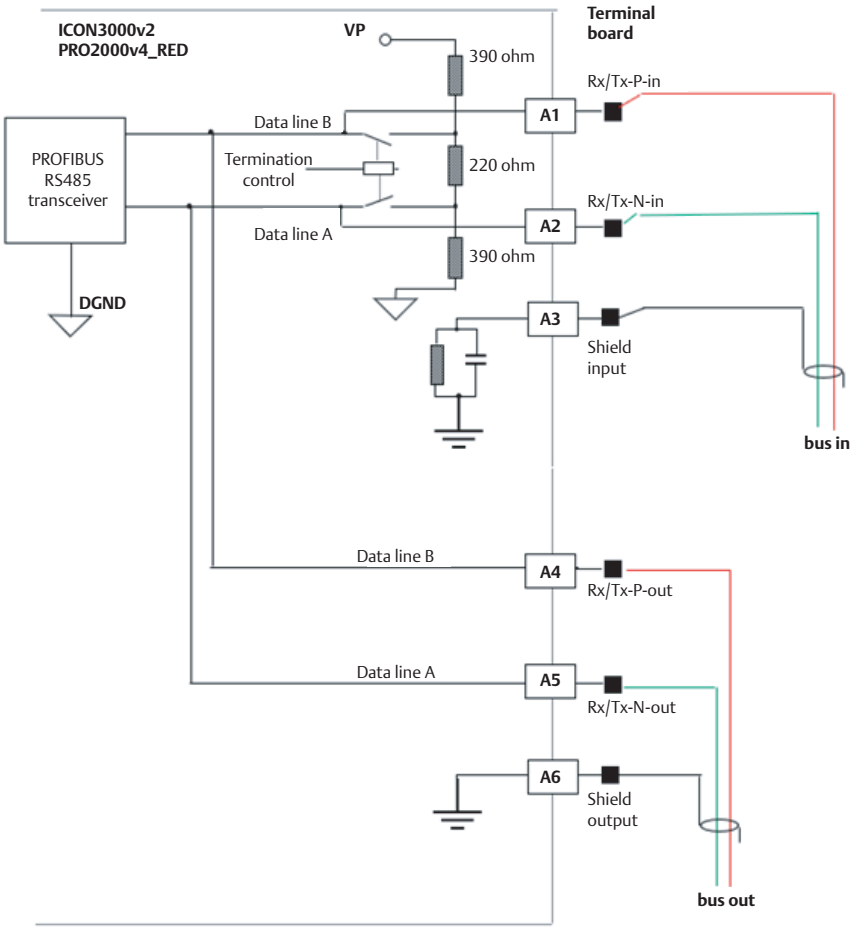


Figure 17 Wiring connection for ICON3000v2 actuator



Section 8: Master Controller (PLC) Commissioning

8.1 GSD Installing

A GSD is a readable ASCII text file and contains both general and device-specific specifications for communications. Each of the entries describes a feature that is supported by a device.

A GSD supports automatic checks for input errors and data consistency.

GSD name: ICO20FD9.gsd

The following pictures shown the steps for the GSD installing for the Hardware configuration interface in the SIMATIC STEP 7.

NOTICE

For the GSD installation in the SIMATIC STEP 7 Totally Integrated Automation Portal (TIA Portal) the steps are the same apart that Device and Network configuration interface is used in place of the Hardware configuration.

All the next folders and filenames can chance following the device installation is ongoing.

- Install the GSD file of the device present in the folder receive from Biffi.

Figure 18

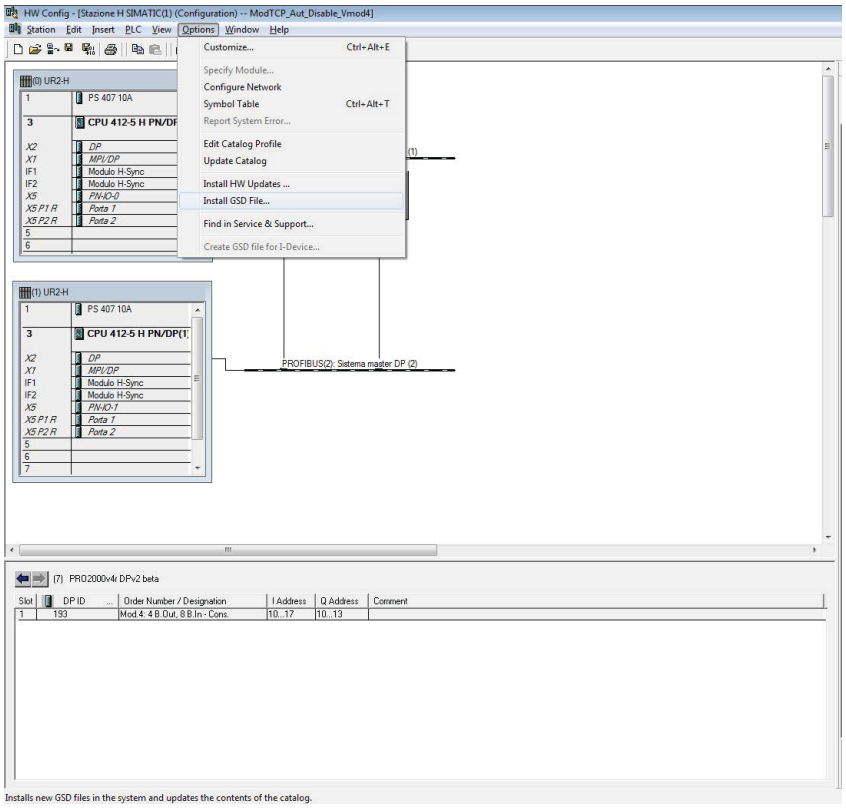


Figure 19

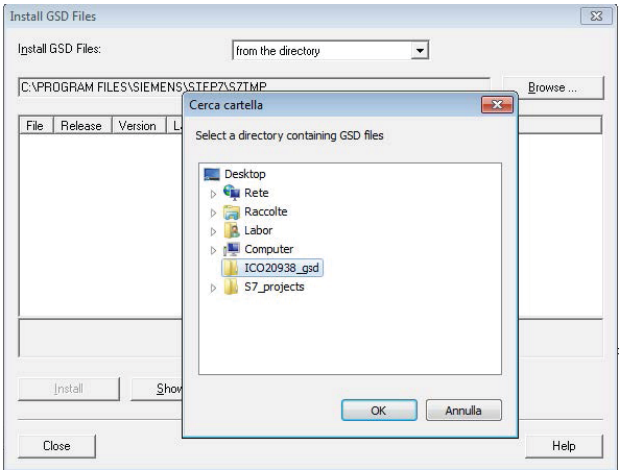


Figure 20

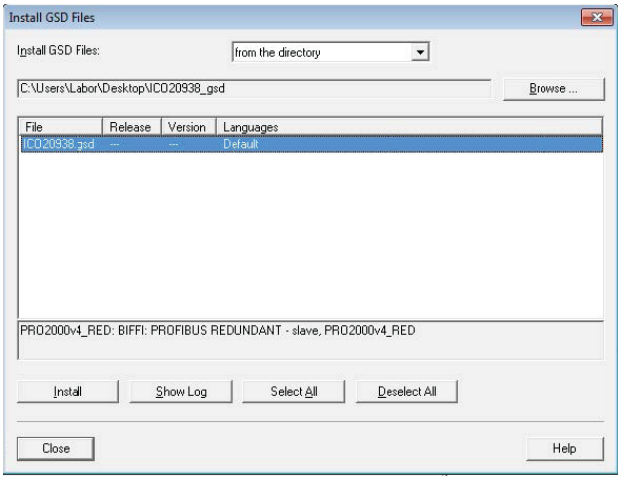
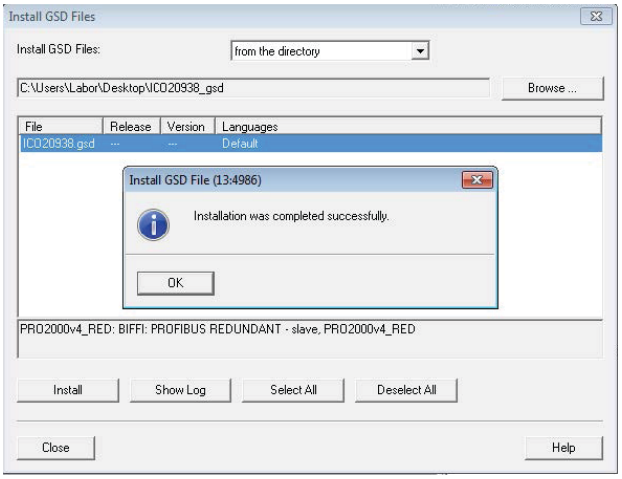


Figure 21



- Then insert the object in the PROFIBUS network.

Figure 22

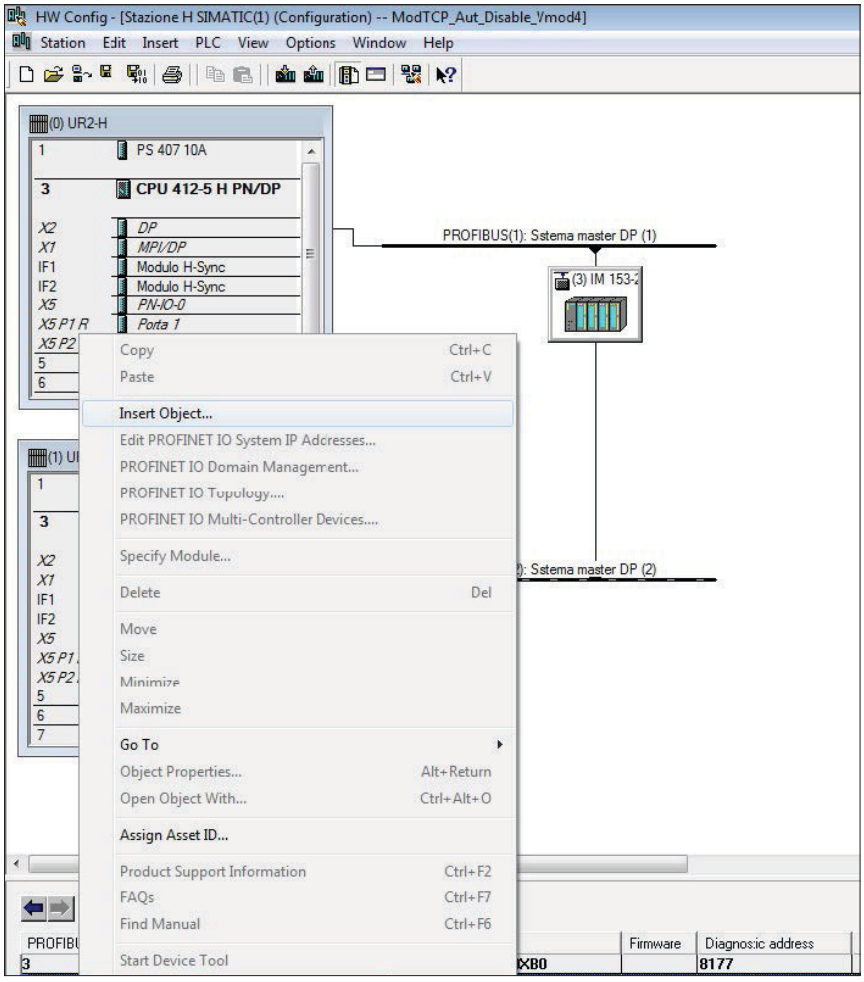
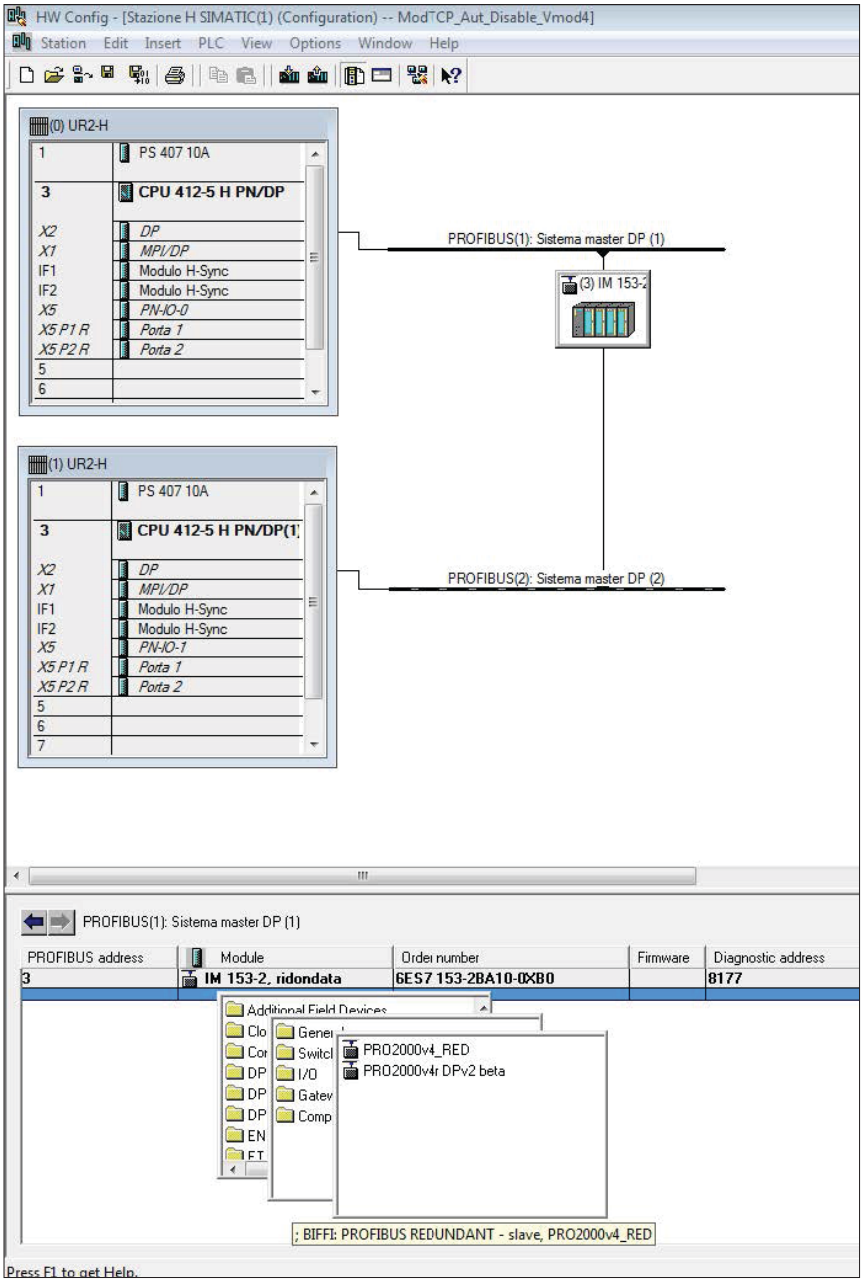
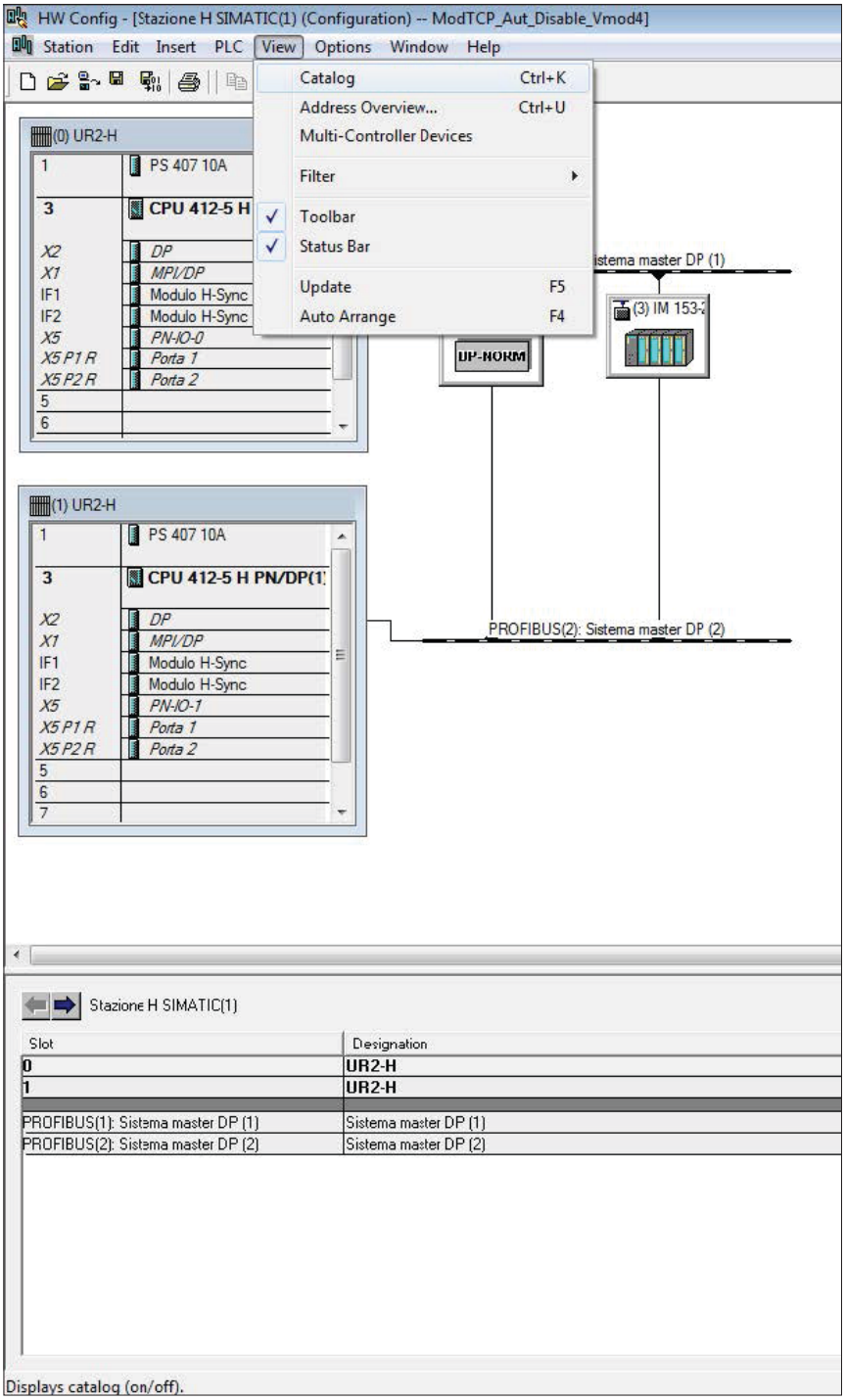


Figure 23


HW Config - [Stazione H SIMATIC(1) (Configuration) -- ModTCP_Aut_Disable_Vmod4]
Station Edit Insert PLC View Options Window Help
(0) UR2-H
1 PS 407 10A
3 CPU 412-5 H PN/DP
X2 DP
X1 MPI/DP
IF1 Modulo H-Sync
IF2 Modulo H-Sync
X5 PN-IO-0
X5 P1 R Porta 1
X5 P2 R Porta 2
5
6
PROFIBUS(1): Sistema master DP (1)
(3) IM 153-2
(1) UR2-H
1 PS 407 10A
3 CPU 412-5 H PN/DP(1)
X2 DP
X1 MPI/DP
IF1 Modulo H-Sync
IF2 Modulo H-Sync
X5 PN-IO-1
X5 P1 R Porta 1
X5 P2 R Porta 2
5
6
7
PROFIBUS(2): Sistema master DP (2)
PROFIBUS(1): Sistema master DP (1)
PROFIBUS address
Module
Order number
Firmware
Diagnostic address
3
IM 153-2, ridondata
6ES7 153-2BA10-0XB0
8177
Additional Field Devices
PRO2000v4_RED
PRO2000v4r DPv2 beta
; BIFFI: PROFIBUS REDUNDANT - slave, PRO2000v4_RED
Press F1 to get Help.

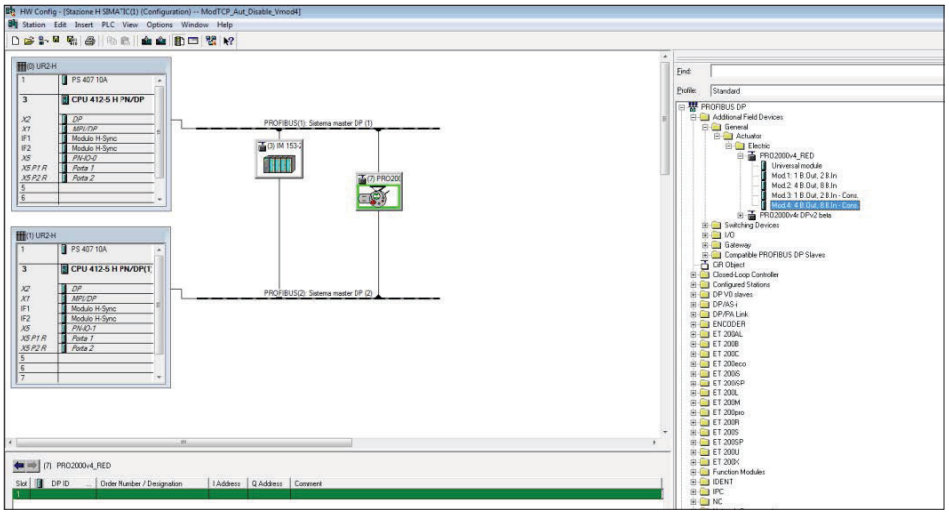
- At this time, the time of Module has to be inserted (1, 2, 3, or 4).

Figure 24



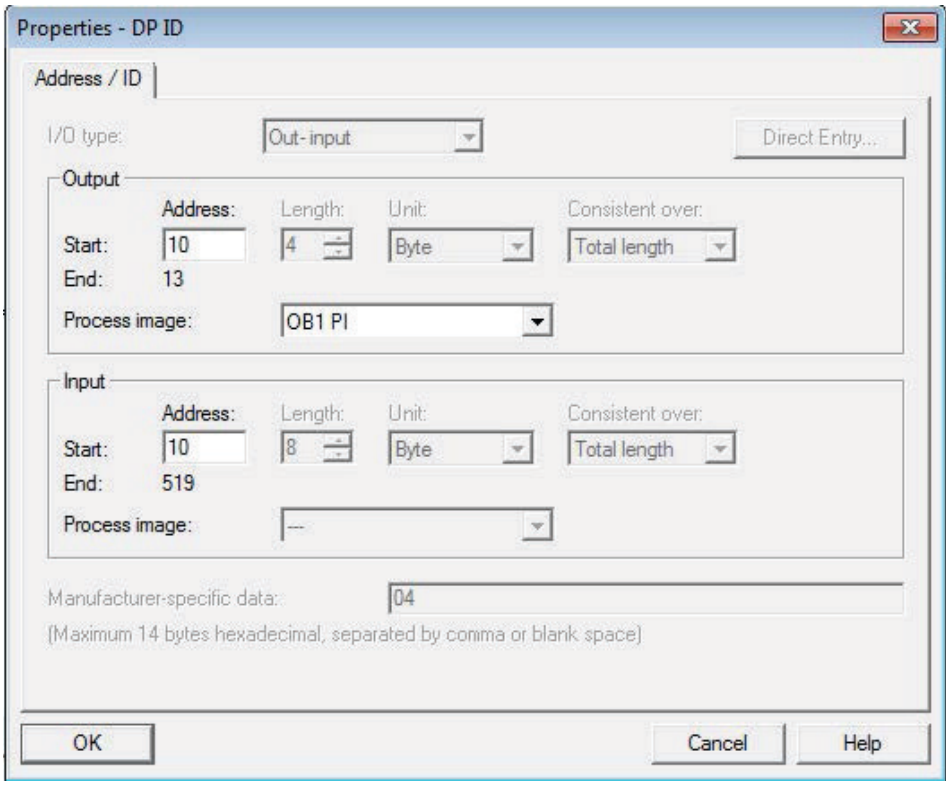
- Then drag and drop the select Module to the green line as shown.

Figure 25



- Finally select the DP PROFIBUS address and press OK.

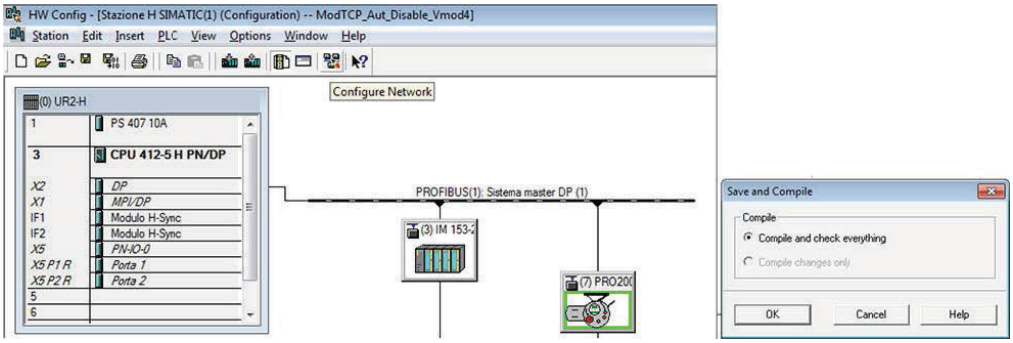
Figure 26



It is suggested to follow the next steps in order to Load the Hardware configuration to the PLC.

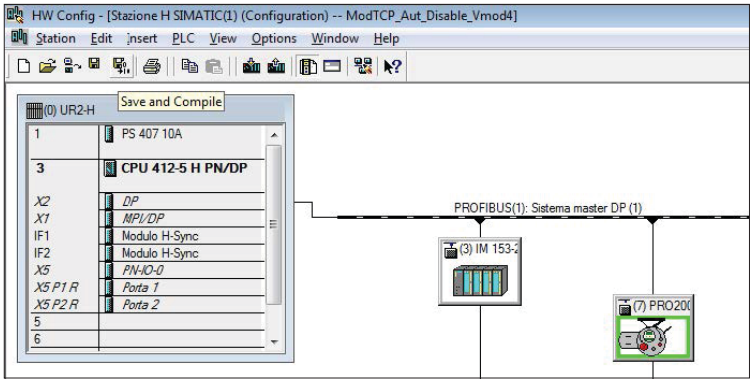
- Configure Network and Compile from the SIMATIC NetPro.

Figure 27



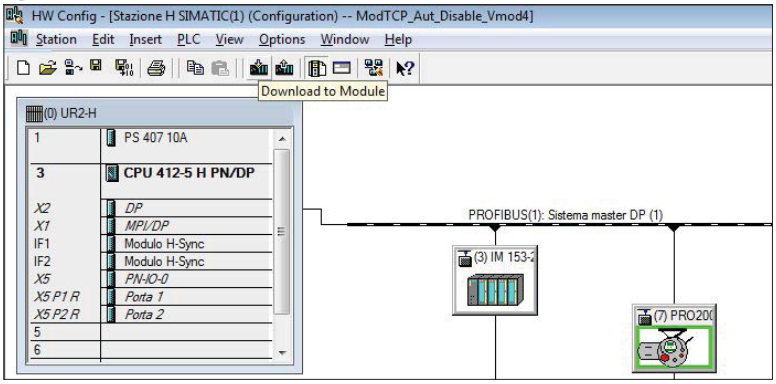
- Save and Compile from the HW configuration.

Figure 28



- Finally Load to the PLC.

Figure 29



8.2 PRO2000V4_RED Interface

The following data sent to the PRO2000v4_RED interface. They are the user specified parameters.

Table 2.

Byte	Name	Type	Range	Default	EU
0	Storage Format	1 byte	0 1	LSB first	LSB first MSB first
1	Fail-Safe Action	1 byte	0 1 2 3 4	Off	Off Close Open Stayput Go to position
2	Delay before initiating safe operation	1 byte	0 - 255	4	seconds
3	Safe Position	1 byte	0 - 100	50	%
4	Timer Open direction - status	1 byte	0	Off	Off On
5	Timer Open direction - on time	1 byte	1	2	seconds
6	Timer Open direction - off time	1 byte	2 - 200	2	seconds
7	Timer Open direction - start position	1 byte	1 - 200	0	%
8	Timer Open direction - stop position	1 byte	0 - 100	100	%
9	Timer Close direction - status	1 byte	0 1	Off	Off On
10	Timer Close direction - on time	1 byte	2 - 200	2	seconds
11	Timer Close direction - off time	1 byte	1 - 200	2	seconds
12	Timer Close direction - start position	1 byte	0 - 100	100	%
13	Timer Close direction - stop position	1 byte	0 - 100	0	%
14	Reserved	1 byte	-	-	-
15	Dead band	1 byte	1 - 255	10	tenth of %
16	Motion inhibit	1 byte	1 - 255	6	seconds

It should be noted that every time that PROFIBUS communication is established, the parameterization string will be sent to the device writing the parameters to the set-up values. The values in parameterization string shall be modified at the Master station.

Byte 0 **Storage Format**

It defines the format of the variables that are transmitted on 2 or 4 bytes.
The setting of this parameter affects the format of the following data:

Output Data: (if Module 2 is selected)
Position Request

Input Data: (if Module 2 is selected)
Actuator Position, Output Torque

General Maintenance Info: Slot 2, Index 0
Actuator Position, Output Torque, Opening Time, Closing Time, Contactor Cycles, Motor Run Time, Time Without Power, Utilization Rate

Recent Maintenance Info: Slot 2, Index 1
Recent Contactor Cycles, Recent Motor Run Time, Recent Time Without Power, Recent Utilization Rate

Value: 0: LSB byte is transmitted first (default setting)
1: MSB byte is transmitted first

Byte 1 **Fail-Safe Action**
It defines the action of the actuator in case of loss of the bus signal. The action takes place only if the local selector is on REMOTE position and if the bus is operating. When the bus signal restores, also the actuator restores at its normal functioning.

Value: 0: Off - disable (default setting)
1: Close
2: Open
3: Stay put
4: Go to position indicated in the parameter 'Safe position'

Byte 2 **Delay before initiating Fail-Safe operation**
It defines the delay before executing the programmed Safe Action.

Value: minimum 0 s
maximum 255 s
default value: 4 s

Byte 3 **Safe position**
It defines the Safe position when 'Safe Action: go to position' is selected.

Value: minimum 0 %
maximum 100%
default value: 50%

Byte 4 **Timer Open Direction - Status**
It enables the Timer function in Open direction.

Value: 0: Off - disable (default setting)
1: On

Byte 5 **Timer Open Direction - On time**
It defines the On time of the Timer function in opening.

Value: minimum 2 s
maximum 200 s
default value: 2 s

Byte 6 **Timer Open Direction - Off time**
It defines the Off time of the Timer function in opening.

Value: minimum 1 s
maximum 200 s
default value: 2 s

Byte 7 **Timer Open Direction - Start position**
It defines the start position of the Timer function in opening.

Value: minimum 0%
maximum 100%
default value: 0%

Byte 8 **Timer Open Direction - Stop position**
It defines the stop position of the Timer function in opening.

Value: minimum 100%
maximum 0%
default value: 100%

Byte 9 **Timer Close Direction - Status**
It enables the Timer function in Close direction.

Value: 0: Off - disable (default setting)
1: On

Byte 10 **Timer Close Direction - On time**
It defines the On time of the Timer function in closing.

Value:		
	minimum	2 s
	maximum	200 s
	default value:	2 s

Byte 11 **Timer Close Direction - Off time**
It defines the Off time of the Timer function in closing.

Value:		
	minimum	1 s
	maximum	200 s
	default value:	2 s

Byte 12 **Timer Close Direction - Start position**
It defines the start position of the Timer function in closing.

Value:		
	minimum	100%
	maximum	0%
	default value:	100%

Byte 13 **Timer Close Direction - Stop position**
It defines the stop position of the Timer function in closing.

Value:		
	minimum	0%
	maximum	100%
	default value:	0%

Byte 14 **Reserved**

Byte 15 **Dead band**
It defines in tenth % of the Dead band of the positioning function available on the modulating actuator. The movement is inhibited until the difference between current position and requested position (position error) is lower than Dead band.

Value:			
	minimum	1	0.1%
	maximum	255	22.5%
	default value:	10	1.0%

Byte 16 **Motion inhibit time**
It defines the minimum delay between two cycles of the motor when the actuator is in modulating service. It allows to adjust the number of start per hour of the electric motor.

Value:		
	minimum	1 s
	maximum	255 s
	default value:	6 s

Section 9: Local Operator Interface Commissioning

Here below are described the facilities available by the view and setup menu of ICON3000.

9.1 Bus Control

DIN 1 - DIN 6

- By this routine, it is possible to choose the condition that sets the status of bits DIN1 - 6 of byte 4 when module 2 has been selected. Here below is the list of the available conditions:

Table 3.

The following setting is supplied as standard:

STATUS		ALARM	
• open limit • closed limit • position >= xx % • position <= xx % • closing • opening • motor running	• blinker • mid-travel position • local selected • remote selected • local stop active • ESD/PTS-efs • manual operation • heater	• motor HI-HI temperature • HI-HI - torque • HI-HI - torque in OP • HI-HI - torque in CL • valve jammed • warnings • EFS mid travel alarm • Interlock/PTS-icon	• valve jammed in OP • valve jammed in CL • low battery • mid travel alarm in CL/OP • EFS in manual • PTS failed • MAINS (only as8) • EFS coil OFF

- DIN 1: mid-travel position
- DIN 2: local stop active
- DIN 3: motor over-temperature (motor thermostat alarm)
- DIN 4: over-torque (HI-HI torque alarm)
- DIN 5: valve jammed alarm
- DIN 6: mid-travel alarm in OP/CL

Interface mode:

It is possible to indicate to interface firmware the requested working algorithm. The following selections are available:

- **SINGLE CH1:** the interface enables only the channel 1
- **REDUNDANT BIFFI:** the interface acts redundancy as Biffi specific algorithm (This functionality must be requested when ordering the actuator)
- **REDUNDANT 2.212:** the interface acts redundancy as PROFIBUS PNO Order No: 2.212 specification algorithm (This functionality must be requested when ordering the actuator)
- **SINGLE CH2:** the interface enables only the channel 2 (This functionality works only if the slave interface is redundant)

Primary:

- **NODE:** By this function, it is possible to enter the PROFIBUS slave node address of the Primary Slave. The available address range is from 1 to 126. The address must be selected according to the PROFIBUS network layout where the actuator is inserted.
- **TERMINATION:** Status: by this routine the internal termination of the Primary Slave can be connected to the bus line (ON/OFF). Set “TERMINATION = ON” only if the actuator is at the beginning or at the end of the PROFIBUS line.

Backup:

- **NODE:** By this function, it is possible to enter the PROFIBUS slave node address of the Backup Slave. The available address range is from 1 to 126. The address must be selected according to the PROFIBUS network layout where the actuator is inserted.
  - SYSTEM REDUNDANCY: BACKUP NODE = PRIMARY NODE
  - FLYING REDUNDANCY: BACKUP NODE = PRIMARY NODE+64
- **TERMINATION:** Status: by this routine, the internal termination of the Backup Slave can be connected to the bus line (ON/OFF). Set “TERMINATION = ON” only if the actuator is at the beginning or at the end of the PROFIBUS line.

Configuration procedure:

- Move the local selector to OFF and then press simultaneously OPEN and STOP. Select the language and then enter the password according to the instructions “entering the set-up mode”. When the message of display is “SET-UP MODE OK?” press YES. Press YES to select “ACTUATOR SET-UP” menu, press NO to scroll the list of available routines and then press YES to select BUS control
- Press NO if the condition linked to DIN 1 is correct, or press YES to change, press NO to select new option, then press YES to confirm
- Repeat the previous step for DIN 2, DIN 3 - DIN 6
- Press YES if the INTERFACE MODE is correct, or press NO to change
- Press YES to enter in configuration of PRIMARY channel or press NO to skip configuration of Primary channel
- Press YES if the configured value of the node address (NODE) is correct (from 1 to 126), or press NO to change, then press YES
- Press YES if the configured status of termination (TERMINATION) is correct (ON/OFF), or press NO to change, then press YES
- Press YES to enter in configuration of BACKUP channel or press NO to skip configuration of Backup channel. Like PRIMARY menu, the BACKUP menu contains the NODE and TERMINATION settings

View procedure:

- Move the local selector to OFF and then press simultaneously OPEN and STOP. Select the language and then enter the password according to the instructions “entering the view mode”. When the message of display is “VIEW MODE OK?” press YES. Press YES to select “ACTUATOR SET-UP” menu, press NO to scroll the list of available routines and then press YES to select BUS CONTROL
- Press YES to scroll the list of BUS CONTROL parameters

9.2 Node Report

The following procedure allows seeing the most significant info relevant to the bus data transmission of the PRO2000v4_RED interface card.

The following indication are reported:

INTERFACE STATUS

This information reports the status of PROFIBUS slave interface card interface. It is a hexadecimal word. The Higher Byte o the word represents the status of Primary (IM1) and the Lower Byte represents the status of Backup (IM2).

Bit Field representation:

b14-15 = IM1 WD_State

- 00 = 'Baud_Search' state
- 01 = 'Baud_Control' state
- 10 = 'DP_Control' state
- 11 = not possible

b12-13 = IM1 DP_State

- 00 = 'Wait_Prm' state
- 01 = 'Wait_Cfg' state
- 10 = 'DATA_EX' state
- 11 = not possible

b11 = IM1 RAM Access Violation

- 0 = no address violation
- 1 = address violation

b10 = IM1 Diag_Flag

- 0 = the DP master fetch the diagnostic buffer
- 1 = the DP master has not yet fetched the diagnostic buffer

b9 = IM1 FDL_IND_ST

- 0 = no FDL indication is temporarily buffered
- 1 = FDL indication is temporarily buffered

b8 = IM1 Offline/Passive Idle

- 0 = VPC3 is in offline
- 1 = VPC3 is passive idle

b6-7 = IM2 WD_State

- 00 = 'Baud_Search' state
- 01 = 'Baud_Control' state
- 10 = 'DP_Control' state
- 11 = not possible

b4-5 = IM2 DP_State

- 00 = 'Wait_Prm' state
- 01 = 'Wait_Cfg' state
- 10 = 'DATA_EX' state
- 11 = not possible

b3 = IM2 RAM Access Violation

- 0 = no address violation
- 1 = address violation

b2 = IM2 Diag_Flag

- 0 = the DP master fetch the diagnostic buffer
- 1 = the DP master has not yet fetched the diagnostic buffer

b1 = IM2 FDL_IND_ST

- 0 = no FDL indication is temporarily buffered
- 1 = FDL indication is temporarily buffered

b0 = IM2 Offline/Passive Idle

- 0 = VPC3 is in offline
- 1 = VPC3 is passive idle

RED MACHINE STAT

This information reports the status of redundancy algorithm of PROFIBUS redundant slave interface if the firmware at the PNO Order No: 2.212 specification. It is a hexadecimal word. The Higher Byte of the word represents the status of Primary (IM1) and the Lower Byte represents the status of Backup (IM2). Refer to PNO Order No: 2.212 Slave redundancy specification for detail on redundancy state machine status values.

BUS CARD REPORT

By this routine, it is possible to show the 64 characters identification string relevant to the PRO2000v4_RED interface.

PRIMARY CARD

- **BAUD RATE:** represents the baud rate detected and hooked by primary channel
  - 0 = 12,00 Mbit/s
  - 1 = 6,00 Mbit/s
  - 2 = 3,00 Mbit/s
  - 3 = 1,50 Mbit/s
  - 4 = 500,00 Kbit/s
  - 5 = 187,50 Kbit/s
  - 6 = 93,75 Kbit/s
  - 7 = 45,45 Kbit/s
  - 8 = 19,20 Kbit/s
  - 9 = 9,60 Kbit/s
  - 15 = after reset and during baud rate search
- **ACTIVE MODULE:** display the selected active module of primary channel

BACKUP CARD

- **BAUD RATE:** represents the baud rate detected and hooked by backup channel
  - 0 = 12,00 Mbit/s
  - 1 = 6,00 Mbit/s
  - 2 = 3,00 Mbit/s
  - 3 = 1,50 Mbit/s
  - 4 = 500,00 Kbit/s
  - 5 = 187,50 Kbit/s
  - 6 = 93,75 Kbit/s
  - 7 = 45,45 Kbit/s
  - 8 = 19,20 Kbit/s
  - 9 = 9,60 Kbit/s
  - 15 = after reset and during baud rate search

ACTIVE MODULE: display the selected active module of backup channel

MB REC-COUNTER: Counter for consecutive communication error between Base card and PRO2000v4_RED interface card. The counter resets every good communication message which is present.

MB GEN-COUNTER: Counter for communication error between Base card and PRO2000v4_RED interface. The counter resets when power off.

View procedure:

- Move the local selector to OFF or REMOTE and then press YES until the display shows NODE REPORT. Press NO to exit or press YES to scroll the list of transmission information.

9.3 Bus Signal Failure Indication

In case of both cards loss the PROFIBUS signal, or are not in DATA-EX state with master, a warning is generated. It is signalled by the flashing of the relevant ALARM/WARNING LED and by indication on the local 2 lines/16 character display. If Fail-safe action is programmed, the actuator performs this procedure.

Section 10: Data Exchange Mode (Cyclic Communication)

The following section describes the input and output messages of PRO2000v4_RED interface when working in “data exchange mode” for “cyclic data” and “acyclic data”. In all cases, it is called “input signal” a data flowing from actuator to bus, vice-versa it is called “output signal” a data flowing from bus to slave.

The PRO2000v4_RED board implements the following modules:

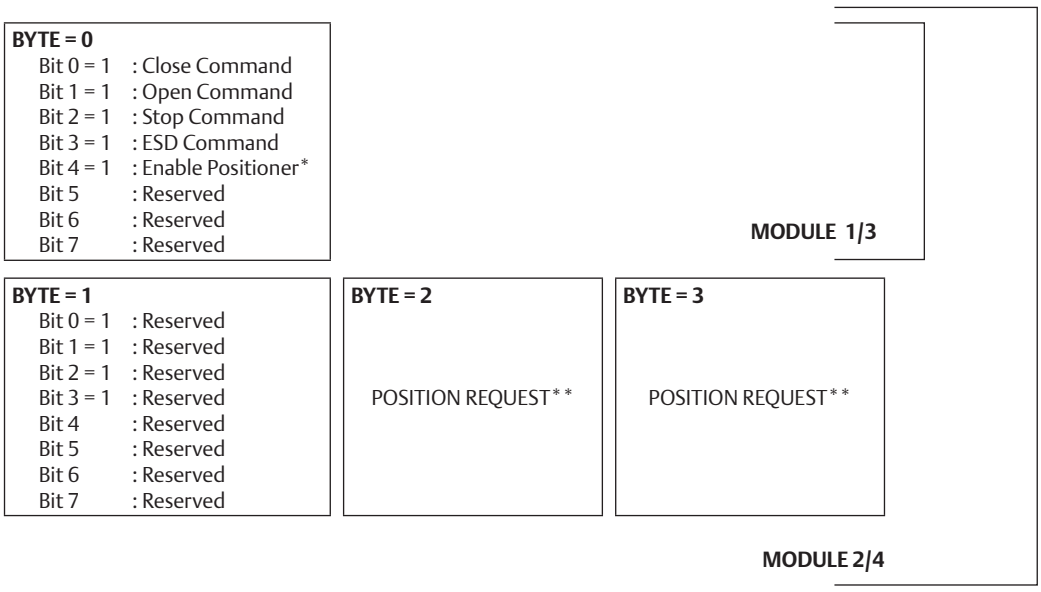
- **Module 1:** 1 byte output; 2 bytes input
- **Module 2:** 4 bytes output; 8 bytes input
- **Module 3:** 1 byte output; 2 bytes input - Consistent
- **Module 4:** 4 bytes output; 8 bytes input - Consistent

Consistent is an attribute that specify the capability of the module to maintain data consistency over the entire data length. In this way, the data will not change during the reading by the PROFIBUS DP-Master.

For example, if module 2 is selected, the output telegram consists in 4 bytes, and the input telegram in 8 bytes.

10.1 Cyclic Communication DPV0

10.1.1 Output Data (PLC to Device)



* In case of module 1: Reserved
** Position request: Integer 16 bits (value 0 = 0%; value 1,000 = 100.0%)

10.1.2 Input Data (Device to PLC)

BYTE = 0 Bit 0 = 1 : Close limit Bit 1 = 1 : Open limit Bit 2 = 1 : Closing Bit 3 = 1 : Opening Bit 4 = 1 : ESD active Bit 5 = 1 : Loc. Sel. on Remote Bit 6 = 1 : Loc. Sel. on Local Bit 7 = 1 : Loc. Sel. on Off	**BYTE = 1** Bit 0 = 1 : Interlock open active Bit 1 = 1 : Interlock close active Bit 2 = 1 : Fail-safe action Bit 3 = 1 : Int. data updated * Bit 4 = 1 : Warning Bit 5 = 1 : MS2 commands ON (cyclic command OFF) Bit 6 = 1 : Primary slave Bit 7 = 1 : Alarm
BYTE = 2 ACTUATOR POSITION §	**BYTE = 3** ACTUATOR POSITION §
BYTE = 4 Bit 0 = 1 : Monitor relay Bit 1 = 1 : Motion inhibited Bit 2 = 1 : DIN 1 Bit 3 = 1 : DIN 2 Bit 4 = 1 : DIN 3 Bit 5 = 1 : DIN 4 Bit 6 = 1 : DIN 5 Bit 7 = 1 : DIN 6	**BYTE = 5** Bit 0 = 1 : Aux. in open Bit 1 = 1 : Aux.in close Bit 2 = 1 : Aux. in stop Bit 3 = 1 : Aux. in bus-on Bit 4 = 1 : HW remote mode Bit 5 = 1 : Positioner mode Bit 6 : Reserved Bit 7 : Reserved
BYTE = 6 OUTPUT TORQUE §§	**BYTE = 7** OUTPUT TORQUE §§

MODULE 1/3

MODULE 2/4

* 'Internal data updated' is set to 1 when the Active Slave has updated its internal data area and the acyclic communications can read updated values.

** 'Valid data' is set to 1 when the PROFIBUS interface is the Active Slave and the cyclic communications contains valid data.

§ Position: Integer 16 bits (value 0 = 0%; value 1,000 = 100.0%)

§§ Torque: Integer 16 bits (OP: value 0 = 0%; value –100 = 100% - CL: value 0 = 0%; value +100 = 100%)

DIN setting

Via local operator interface of actuator, the DIN bits can be individually set to 1 if one of the conditions in the list in Section 9.1, Bus Control.

10.2 Acyclic Communication DPV1 (MS2)

This section defines the composition of the acyclic communication defined as per PROFIBUS DPV1. This information can be reached by PROFIBUS class 2 Master with MS2 services.

10.2.1 Nameplate

Slot 0, Index 0, length 26 byte: Actuator type

Byte	Name	Dim	Range	EU
0 - 15	Actuator Type	16 byte	-	String
16 - 25	Software revision	10 byte	-	String ##

The Software revision string is made up of the base software revision and PROFIBUS interface revision with this format:

SW rev. base (4 byte) – obj. #5	blank	blank	SW rev. interface (4 byte)

Slot 0, Index 1, length 28 byte: Actuator Serial number

Byte	Name	Dim	Range	EU
0 - 27	Serial number	28 byte	-	String

Slot 0, Index 2, length 28 byte: Valve Tag name (Read and Write)

Byte	Name	Dim	Range	EU
0 - 27	Valve Tag name	28 byte	-	String

Slot 0, Index 3, length 240 byte: Reserved (Read and Write)

Byte	Name	Dim	Range	EU
0 - 239	Reserved	240 byte	-	String

10.2.2 General Data and Command

Slot 1, Index 0, length 4 byte: General data about current working condition (Read Only)

Byte	Name	bit	Description
0	Byte 0	0 1 2 3 4 5 6 7	Close limit Open limit Moving Monitor relay Selector in local Selector in remote Alarm Warning
1	Byte 1	0 1 2 3 4 5 6 7	DIN 1 DIN 2 DIN 3 DIN 4 DIN 5 DIN 6 Interlock open Interlock close
2	Byte 2	0 1 2 3 4 5 6 7	Fail-safe action Opening Closing Selector in off ESD active HW remote mode Positioner mode Motion inhibited
3	Byte 3	0 1 2 3 4 5 6 7	Primary slave Aux. in open Aux. in close Aux. in stop Aux. in bus-on Reserved Reserved Reserved

Slot 1, Index 1, length 16 byte: Pass frase (Write Only)

Byte	Name	Dim	Range	EU
0 - 15	Acyclic string enable	16 byte	String: “enable MS2 write”	Enable Acyclic commands and Disable cyclic commands Every string different from the right one disables Acyclic commands and Enable cyclic commands

Slot 1, Index 2, length 4 byte: MS2 Acyclic command (Write Only)

Byte	Name	bit	Description
0	Byte 0	0 1 2 3 4 5 6 7	Close Command Open Command Stop Command ESD Command Enable Positioner. In case of module 1: Reserved Reserved Reserved Reserved
1	Byte 1	0 1 2 3 4 5 6 7	Reserved Reserved Reserved Reserved Reserved Reserved Reserved Reserved
2	Byte 2	0 - 7	POSITION REQUEST Integer 16 bits (value 0 = 0%; value 1,000 = 100.0%)
3	Byte 3	8 - 15	POSITION REQUEST Integer 16 bits (value 0 = 0%; value 1,000 = 100.0%)

Slot 1, Index 3, length 8 byte: Actuator state data (Read Only)

Byte	Name	bit	Description
0	Byte 0	0 1 2 3 4 5 6 7	Close limit Open limit Closing Opening ESD active Loc. Sel. on Remote Loc. Sel. on Local Loc. Sel. on Off
1	Byte 1	0 1 2 3 4 5 6 7	Interlock open active Interlock close active Fail-safe action Int. data updated. Set to 1 when the Active Slave has updated its internal data area Warning MS2 commands ON (cyclic command OFF) Primary slave Alarms
2	Byte 2	0 - 7	ACTUATOR POSITION Integer 16 bits (value 0 = 0%; value 1,000 = 100.0%)
3	Byte 3	8 - 15	ACTUATOR POSITION Integer 16 bits (value 0 = 0%; value 1,000 = 100.0%)
4	Byte 4	0 1 2 3 4 5 6 7	Monitor relay Motion inhibited DIN 1 DIN 2 DIN 3 DIN 4 DIN 5 DIN 6
5	Byte 5	0 1 2 3 4 5 6 7	Aux. in open Aux. in close Aux. in stop Aux. in bus-on HW remote mode Positioner mode Reserved Reserved
6	Byte 6	0 - 7	OUTPUT TORQUE OP: value 0 = 0%; value –100 = 100% - CL: value 0 = 0%; value +100 = 100%)
7	Byte 7	8 - 15	OUTPUT TORQUE OP: value 0 = 0%; value –100 = 100% - CL: value 0 = 0%; value +100 = 100%)

10.2.3 Maintenance Information for PROFIBUS Guideline Compliance (Read Only)

Slot 1, Index 10, length 22 byte: General maintenance information

Byte	Name	Dim	Range	EU
0 - 1	Actuator position	2 byte	0 - 1000	-
2 - 3	Output torque	2 byte	-100 +100	-
4 - 5	Opening time	2 byte	0 - 65, 535	Seconds
6 - 7	Closing time	2 byte	0 - 65, 535	Seconds
8 - 11	Contactor cycles	4 byte	0 - 4, 294, 967, 295	Unit
12 - 15	Motor Run Time	4 byte	0 - 4, 294, 967, 295	Hours
16 - 19	Time Without Power	4 byte	0 - 4, 294, 967, 295	Hours
20 - 21	Utilization Rate	2 byte	0 - 65, 535	%

Slot 1, Index 11, length 28 byte: Recent maintenance information

Byte	Name	Dim	Range	EU
0 - 6	Test Date	7 bytes	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
7 - 13	Recent log date	7 bytes	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
14 - 17	Recent Contactor Cycles	4 bytes	0 - 4, 294, 967, 295	Unit
18 - 21	Recent motor Run Time	4 bytes	0 - 4, 294, 967, 295	Hours
22 - 25	Recent Time Without Power	4 bytes	0 - 4, 294, 967, 295	Hours
24 - 27	Recent Utilization Rate	2 bytes	0 - 65, 535	%

Slot 1, Index 12, length 26 byte: Torque profile

Byte	Name	Dim	Range	EU
0	Reserved	1 byte	-	-
1	Opening Break out	1 byte	0 - 255	%
2	Reserved	1 byte	-	-
3	Opening Peak	1 byte	0 - 255	%
4	Reserved	1 byte	-	-
5	Opening Ending	1 byte	0 - 255	%
6 - 12	Date Opening	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
13	Reserved	1 byte	-	-
14	Closing Break out	1 byte	0 - 255	%
15	Reserved	1 byte	-	-
16	Closing Peak	1 byte	0 - 255	%
17	Reserved	1 byte	-	-
18	Closing Ending	1 byte	0 - 255	%
19 - 25	Date Closing	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 13, length 26 byte: Reference Torque profile

Byte	Name	Dim	Range	EU
0	Reserved	1 byte	-	-
1	Ref. Opening Break out	1 byte	0 - 255	%
2	Reserved	1 byte	-	-
3	Ref. Opening Peak	1 byte	0 - 255	%
4	Reserved	1 byte	-	-
5	Ref. Opening Ending	1 byte	0 - 255	%
6 - 12	Date Ref. Opening	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
13	Reserved	1 byte	-	-
14	Ref. Closing Break out	1 byte	0 - 255	%
15	Reserved	1 byte	-	-
16	Ref. Closing Peak	1 byte	0 - 255	%
17	Reserved	1 byte	-	-
18	Ref. Closing Ending	1 byte	0 - 255	%
19 - 25	Date Ref. Closing	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 14, length 29 byte: Nominal Torque and Maintenance date

Byte	Name	Dim	Range	EU
0	Nominal Torque EU	1 byte	0 1 2 3	Torque lbf Torque Nm Thrust lb Thrust kN
1 - 7	Nominal Torque Value	7 byte	-	String
8 - 14	Next Maintenance Date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
15 - 21	Last Maintenance Date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
22 - 28	Startup Date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

10.2.4 Alarm and Warning Log for PROFIBUS Guideline Compliance (Read Only)

Slot 1, Index 20, length 26 byte: Alarm log: the first three records

Byte	Name	Dim	Range	EU
0	Alarm #1: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 8	Alarm #1: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
9	Alarm #2: Code	1 byte	0 - 255	-
10	Reserved	1 byte	-	-
11 - 17	Alarm #2: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
18	Alarm #3: Code	1 byte	0 - 255	-
19	Reserved	1 byte	-	-
20 - 26	Alarm #3: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 21, length 18 byte: Alarm log: the last two records

Byte	Name	Dim	Range	EU
0	Alarm #4: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 8	Alarm #4: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
9	Alarm #5: Code	1 byte	0 - 255	-
10	Reserved	1 byte	-	-
11 - 17	Alarm #5: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 22, length 27 byte: Warning log: the first three records

Byte	Name	Dim	Range	EU
0	Warning #1: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 8	Warning #1: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
9	Warning #2: Code	1 byte	0 - 255	-
10	Reserved	1 byte	-	-
11 - 17	Warning #2: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
18	Warning #3: Code	1 byte	0 - 255	-
19	Reserved	1 byte	-	-
20 - 26	Warning #3: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 23, length 18 byte: Warning log: the last two records

Byte	Name	Dim	Range	EU
0	Warning #4: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 8	Warning #4: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	
9	Warning #5: Code	1 byte	0 - 255	-
10	Reserved	1 byte	-	-
11 - 17	Warning #5: Time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0 - 59,999 milliseconds Byte 2 (7, 6 bits res): 0 - 59 minutes Byte 3 (7 bit SU, 6 and 5 res): 0 - 23 hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 month Byte 6 (7 bit res): 0 - 99 years	

10.2.5 Maintenance Commands for PROFIBUS Guideline Compliance

Slot 1, Index 30, length 1 byte: Maintenance information (Write Only)

Byte	Name	Dim	Range	EU
0	Maintenance command	1 byte	bit0 = 1 bit1 = 1	Clear Recent Data Log Set Torque Reference

Slot 1, Index 31, length 7 byte: Maintenance information (Read and Write)

Byte	Name	Dim	Range	EU
0 - 6	Next Maintenance date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 32, length 7 byte: Maintenance information (Read and Write)

Byte	Name	Dim	Range	EU
0 - 6	Last Maintenance date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 33, length 7 byte: Maintenance information (Read and Write)

Byte	Name	Dim	Range	EU
0 - 6	Startup date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): 0, milliseconds not provided Byte 2 (7, 6 bits res): 0, minutes not provided Byte 3 (7 bit SU, 6 and 5 res): 0, hours not provided Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

Slot 1, Index 34, length 7 byte: Date and Time (Write Only)

Byte	Name	Dim	Range	EU
0 - 6	Current time and date	7 byte	Byte 0 and 1 (0 MSB, 1 LSB): milliseconds Byte 2 (7, 6 bits res): minutes Byte 3 (7 bit SU, 6 and 5 res): hours Byte 4 (7, 6, 5 bits day week, 4, 3, 2, 1, 0 bits day month): 1 - 7, 1 - 31 Byte 5 (7, 6 bits res): 1 - 12 months Byte 6 (7 bit res): 0 - 99 years	

NOTICE

- 0 - 99 years: The values 0 - 50 correspond to the years 2000 to 2050; The values 51 - 99 correspond to the years 1951 to 1999
- SU: Standard Time = 0, Daylight Saving Time = 1
- Day of week: Monday = 1, Tuesday = 2, Sunday = 7

10.2.6 Maintenance Information

Slot 2, Index 0, length 22 byte: General maintenance information

Byte	Name	Dim	Range	EU
0 - 1	Actuator position	2 byte	0 - 1,000	-
2 - 3	Output torque	2 byte	-100, +100	-
4 - 5	Opening time	2 byte	0 - 65, 535	Seconds
6 - 7	Closing time	2 byte	0 - 65, 535	Seconds
8 - 11	Contactor cycles	4 byte	0 - 4, 294, 967, 295	Unit
12 - 15	Motor Run Time	4 byte	0 - 4, 294, 967, 295	Hours
16 - 19	Time Without Power	4 byte	0 - 4, 294, 967, 295	Hours
20 - 21	Utilization Rate	2 byte	0 - 65, 535	%

Slot 2, Index 1, length 22 byte: Recent maintenance information

Byte	Name	Dim	Range	EU
0 - 3	Test Date	4 bytes	dd-mm-20yy	BCD format
4 - 7	Recent log date	4 bytes	dd-mm-20yy	BCD format
8 - 11	Recent Contactor Cycles	4 bytes	0 - 4, 294, 967, 295	Unit
12 - 13	Recent motor Run Time	4 bytes	0 - 4, 294, 967, 295	Hours
14 - 17	Recent Time Without Power	4 bytes	0 - 4, 294, 967, 295	Hours
18 - 21	Recent Utilization Rate	2 bytes	0 - 65, 535	%

Slot 2, Index 2, length 20 byte: Torque profile

Byte	Name	Dim	Range	EU
0	Reserved	1 byte	-	-
1	Opening Break out	1 byte	0 - 255	%
2	Reserved	1 byte	-	-
3	Opening Peak	1 byte	0 - 255	%
4	Reserved	1 byte	-	-
5	Opening Ending	1 byte	0 - 255	%
6 - 9	Date Opening	4 byte	dd-mm -20yy	BCD format
10	Reserved	1 byte	-	-
11	Closing Break out	1 byte	0 - 255	%
12	Reserved	1 byte	-	-
13	Closing Peak	1 byte	0 - 255	%
14	Reserved	1 byte	-	-
15	Closing Ending	1 byte	0 - 255	%
16 - 19	Date Closing	4 byte	dd-mm-20yy	BCD format

Slot 2, Index 3, length 20 byte: Reference Torque profile

Byte	Name	Dim	Range	EU
0	Reserved	1 byte	-	-
1	Ref. Opening Break out	1 byte	0 - 255	%
2	Reserved	1 byte	-	-
3	Ref. Opening Peak	1 byte	0 - 255	%
4	Reserved	1 byte	-	-
5	Ref. Opening Ending	1 byte	0 - 255	%
6 - 9	Date Ref. Opening	4 byte	dd-mm -20yy	BCD format
10	Reserved	1 byte	-	-
11	Ref. Closing Break out	1 byte	0 - 255	%
12	Reserved	1 byte	-	-
13	Ref. Closing Peak	1 byte	0 - 255	%
14	Reserved	1 byte	-	-
15	Ref. Closing Ending	1 byte	0 - 255	%
16 - 19	Date Ref. Closing	4 byte	dd-mm-20yy	BCD format

Slot 2, Index 4, length 20 byte: Nominal Torque and Maintenance date

Byte	Name	Dim	Range	EU
0	Nominal Torque EU	1 byte	0 1 2 3	Torque lbf Torque Nm Thrust lb Thrust kN
1 - 7	Nominal Torque value	7 byte	-	String
8 - 11	Next Maintenance Date	4 byte	dd-mm-20yy	BCD format
12 - 15	Last Maintenance Date	4 byte	dd-mm-20yy	BCD format
16 - 19	Startup Date	4 byte	dd-mm-20yy	BCD format

10.2.7 Alarm and Warning Log

Slot 3, Index 0, length 30 byte: Alarm log: the first three records

Byte	Name	Dim	Range	EU
0	Alarm #1: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 5	Alarm #1: Date	4 byte	dd-mm-20yy	BCD format
6 - 9	Alarm #1: Time	4 byte	00-hh-mm-ss	BCD format
10	Alarm #2: Code	1 byte	0 - 255	-
11	Reserved	1 byte	-	-
12 - 15	Alarm #2: Date	4 byte	dd-mm-20yy	BCD format
16 - 19	Alarm #2: Time	4 byte	00-hh-mm-ss	BCD format
20	Alarm #3: Code	1 byte	0 - 255	-
21	Reserved	1 byte	-	-
22 - 25	Alarm #3: Date	4 byte	dd-mm-20yy	BCD format
26 - 29	Alarm #3: Time	4 byte	00-hh-mm-ss	BCD format

Slot 3, Index 1, length 20 byte: Alarm log: the last two records

Byte	Name	Dim	Range	EU
0	Alarm #4: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 5	Alarm #4: Date	4 byte	dd-mm-20yy	BCD format
6 - 9	Alarm #4: Time	4 byte	00-hh-mm-ss	BCD format
10	Alarm #5: Code	1 byte	0 - 255	-
11	Reserved	1 byte	-	-
11 - 15	Alarm #5: Date	4 byte	dd-mm-20yy	BCD format
16 - 19	Alarm #5: Time	4 byte	00-hh-mm-ss	BCD format

Slot 3, Index 2, length 30 byte: Warning log: the first three records

Byte	Name	Dim	Range	EU
0	Warning #1: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 5	Warning #1: Date	4 byte	dd-mm-20yy	BCD format
6 - 9	Warning #1: Time	4 byte	00-hh-mm-ss	BCD format
10	Warning #2: code	1 byte	0 - 255	-
11	Reserved	1 byte	-	-
11 - 15	Warning #2: Date	4 byte	dd-mm-20yy	BCD format
16 - 19	Warning #2: Time	4 byte	00-hh-mm-ss	BCD format
20	Warning #3: Code	1 byte	0 - 255	-
21	Reserved	1 byte	-	-
22 - 15	Warning #3: Date	4 byte	dd-mm-20yy	BCD format
26 - 29	Warning #3: Time	4 byte	00-hh-mm-ss	BCD format

Slot 3, Index 3, length 20 byte: Warning log: the last two records

Byte	Name	Dim	Range	EU
0	Warning #4: Code	1 byte	0 - 255	-
1	Reserved	1 byte	-	-
2 - 5	Warning #4: Date	4 byte	dd-mm-20yy	BCD format
6 - 9	Warning #4: Time	4 byte	00-hh-mm-ss	BCD format
10	Warning #5: Code	1 byte	0 - 255	-
11	Reserved	1 byte	-	-
12 - 15	Warning #5: Date	4 byte	dd-mm-20yy	BCD format
16 - 19	Warning #5: Time	4 byte	00-hh-mm-ss	BCD format

10.2.8 Maintenance Commands

Slot 4, Index 0, length 1 byte: Maintenance information (Write Only)

Byte	Name	Dim	Range	EU
0	Maintenance command	1 byte	bit0 = 1 bit1 = 1	Clear Recent Data Log Set Torque Reference

Slot 4, Index 1, length 4 byte: Maintenance information (Read and Write)

Byte	Name	Dim	Range	EU
0 - 3	Next Maintenance Date	4 byte	dd-mm-20yy	BCD format

Slot 4, Index 2, length 4 byte: Maintenance information (Read and Write)

Byte	Name	Dim	Range	EU
0 - 3	Last Maintenance Date	4 byte	dd-mm-20yy	BCD format

Slot 4, Index 3, length 4 byte: Maintenance information (Read and Write)

Byte	Name	Dim	Range	EU
0 - 3	Startup Date	4 byte	dd-mm-20yy	BCD format

Slot 4, Index 4, length 8 byte: Date and Time (Only)

Byte	Name	Dim	Range	EU
0 - 3	Current Date	4 bytes	dd-mm-20yy	BCD format
4 - 7	Current Time	4 bytes	00-hh-mm-ss	BCD format

Section 11: Diagnosis - Alarms

The PRO2000v4_RED interface manages the diagnosis indication coming from the actuator as stated by the standard and the extended PROFIBUS DP V1 alarms.

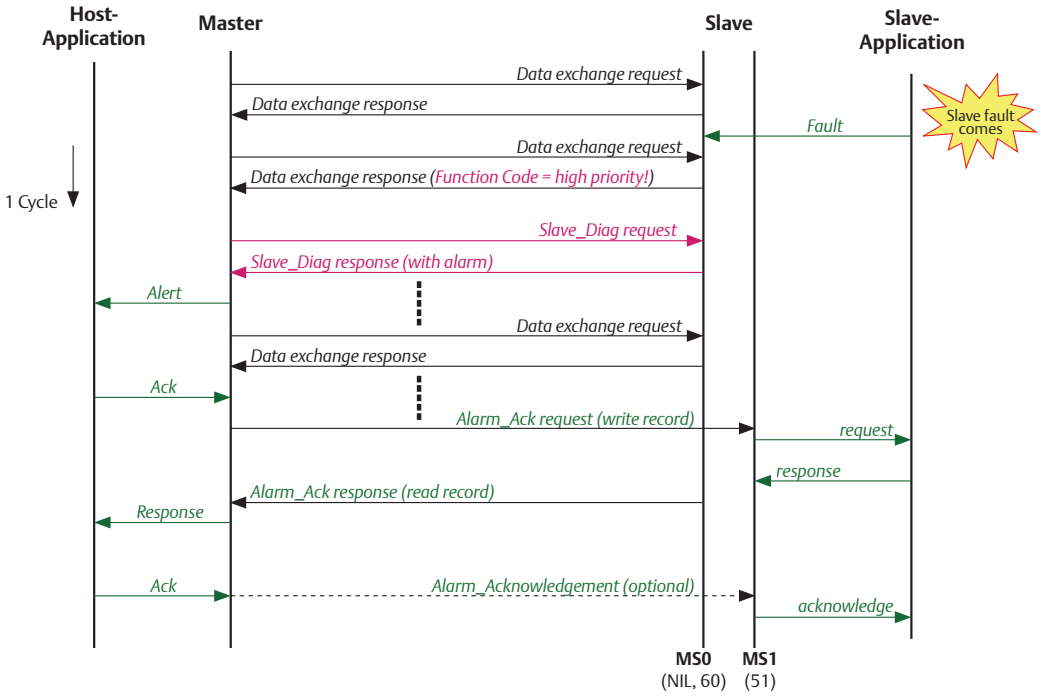
The meaning of every diagnosis event listed in the extended diagnosis block is documented in GSD file where to each bit corresponds a specific text to describe the device related diagnosis.

A full PROFIBUS DP Master compliant should be able to show directly the correspondent text in the event of a diagnostic incident.

When the PRO2000v4_RED interface needs to notify a fault to the master while in data exchange mode, it changes the function code in its response message to “high priority”. During the next regular bus cycle, the master in turn send a “Slave_Diag” request that is answered with a “Slave_Diag” response. The availability of the actuator specific diagnosis information is notified by Dia.Ext_Diag flag set to 1. Once the master was able to catch the diagnosis information it returns to the standard cyclic data exchange mode. To notify the termination of the diagnosis incident the PRO2000v4_RED interface sends a “high priority” response. The master answers with a “Slave_Diag” request that is followed by a “Slave_Diag” response with Dia.Ext_Diag flag set to 0.

With additional acyclic write read service message MS1 the master acknowledges the alarm.

Figure 30



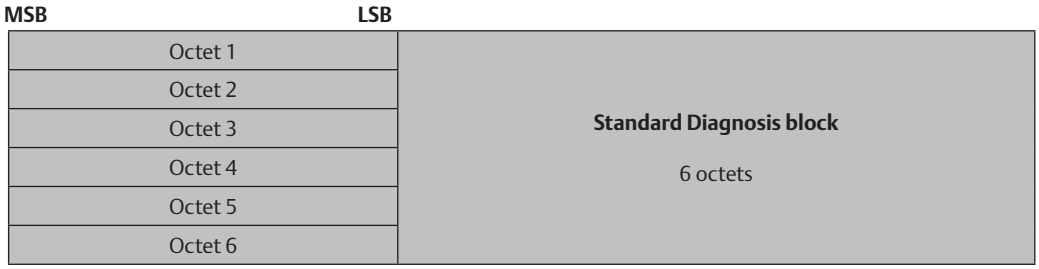
11.1 Diagnosis Data Blocks

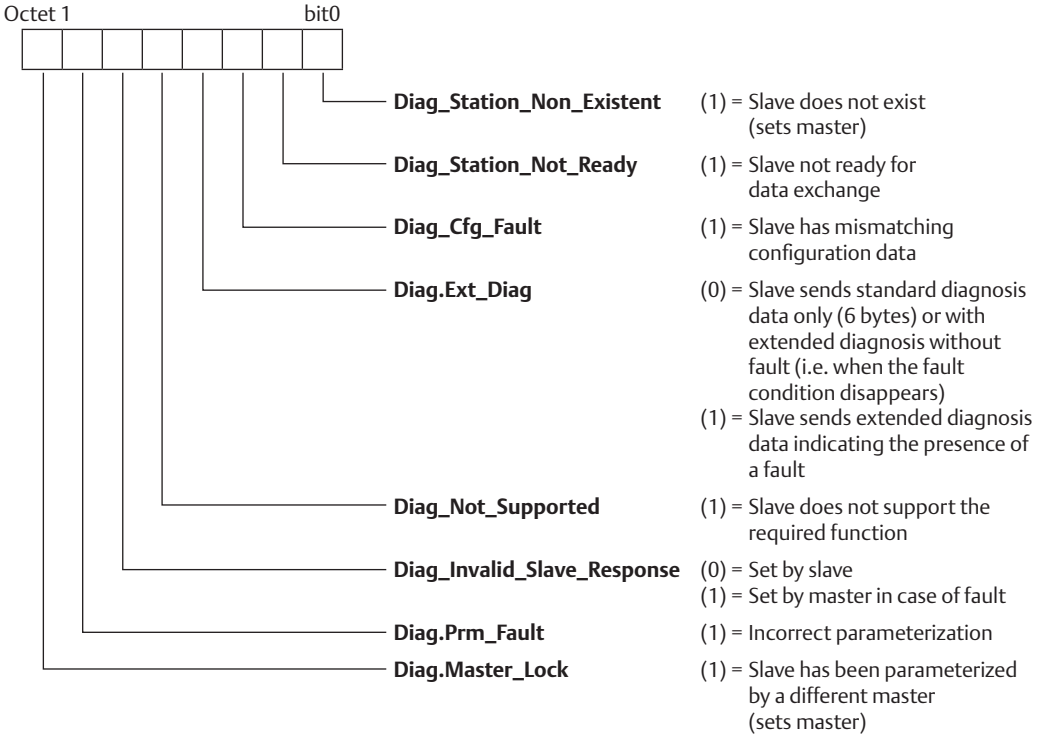
The Slave diagnostic response is composed by one or more of the following data blocks. It is part of the PLC application take care of the information inside each block.

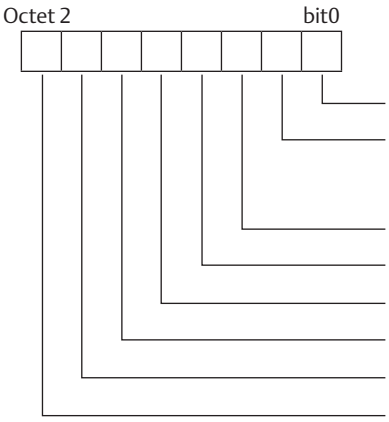
11.1.1 Standard Diagnosis Block

In Figure 32, the structuring of the Standard Diagnosis block is presented.

Figure 32







(1) = Slave has to be reparameterized

(1) = During startup phase, slave not able to provide valid diagnosis data

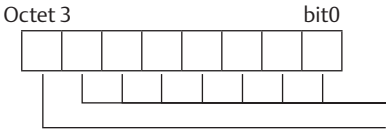
(1) = Fixed at 1

(1) = Threshold monitoring activated

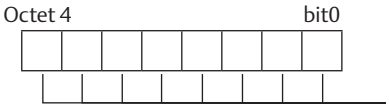
(1) = FREEZE command received

(1) = SYNC command received

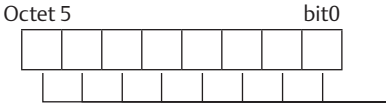
(1) = Diagnosis deactivated (sets master)



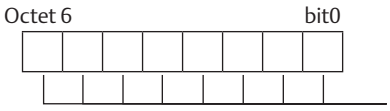
(1) = Slave has more diagnosis data than fit into the buffer



Address of the master that has parameterized the slave. 0xFF when slave not parameterized yet



High byte of the slave's identification number. PRO2000v4_RED report 0x0F

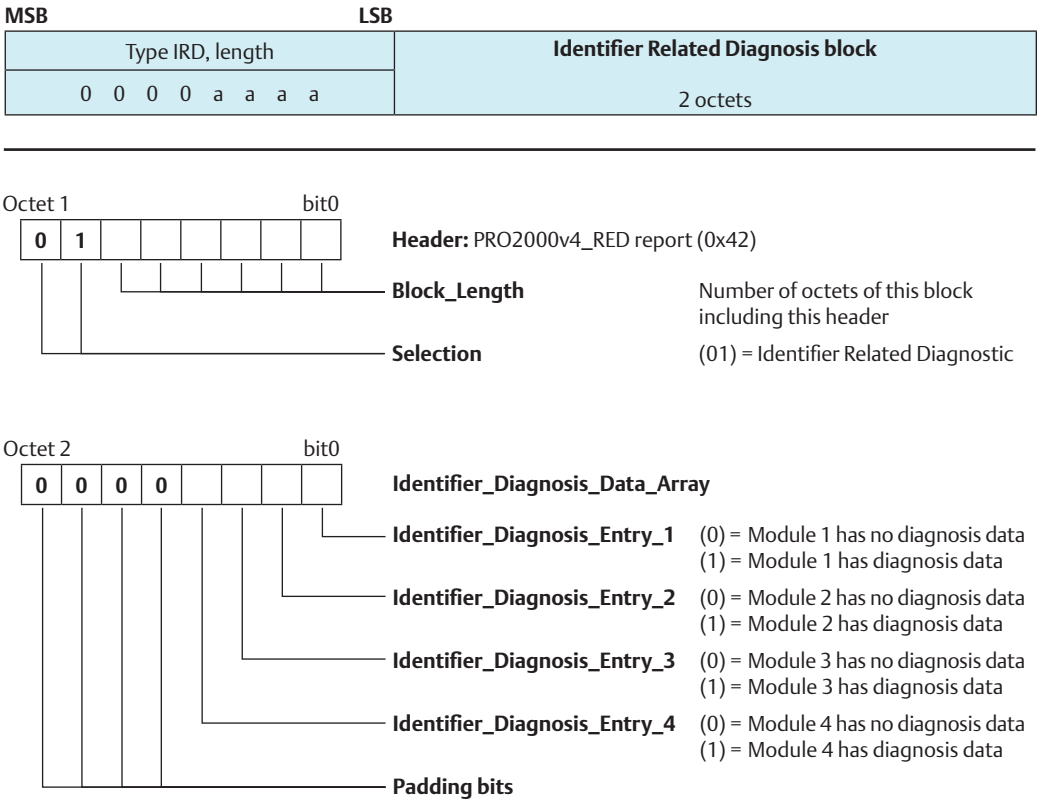


Low byte of the slave's identification number. PRO2000v4_RED report 0xD9

11.1.2 Identify Related Block

In Figure 33, the structuring of the Identifier Related Diagnosis block is presented.

Figure 33

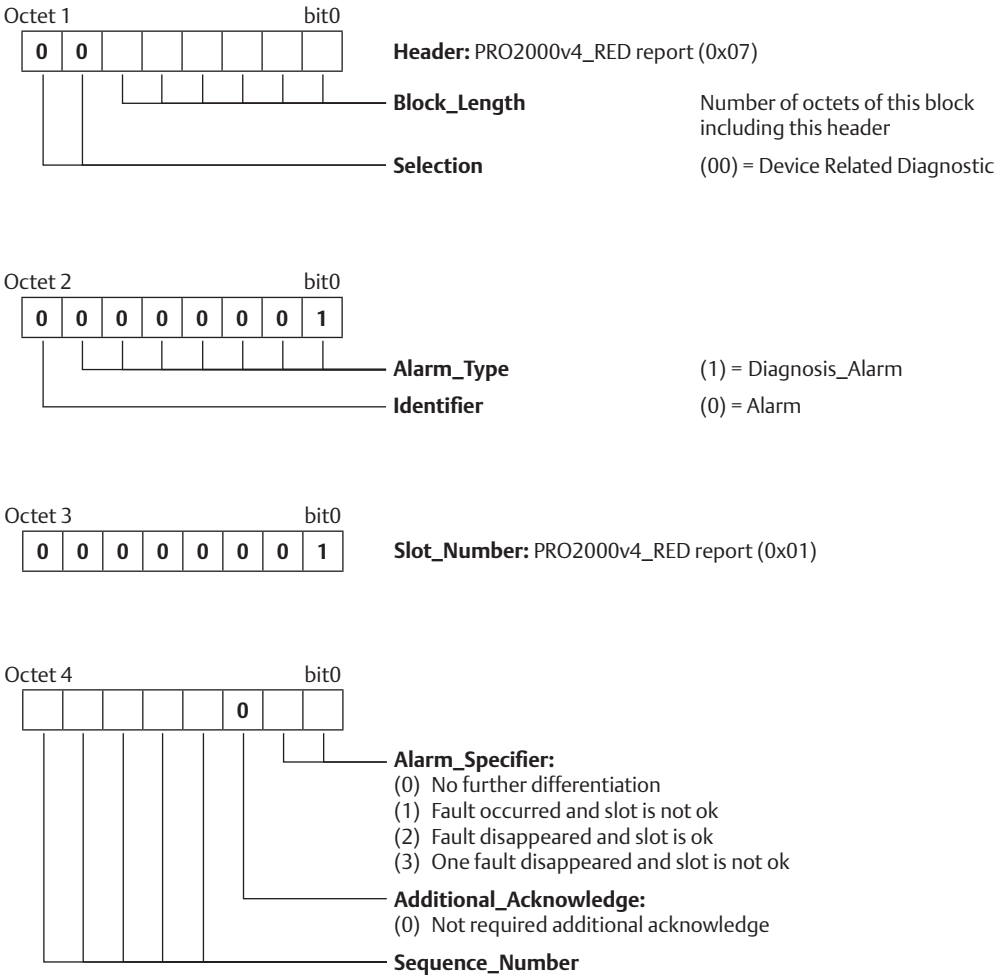


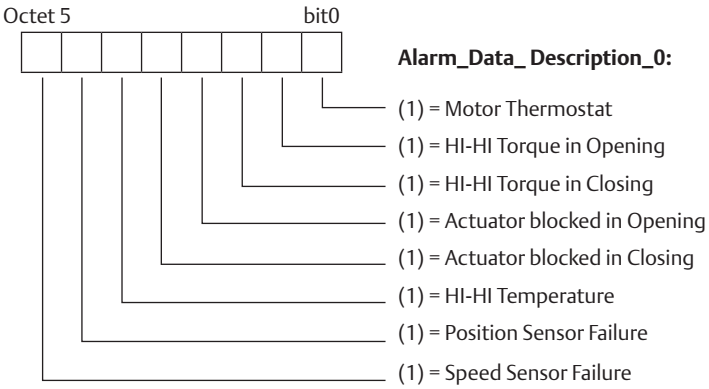
11.1.3 Actuator Specific Diagnostic Alarm

In Figure 34, the structuring of the Diagnosis Alarm block is presented.

Figure 34

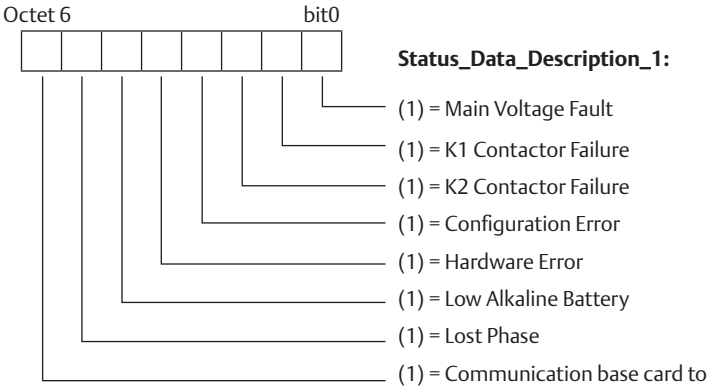
MSB	LSB
Type DRD, Length	**Actuator Diagnosis block Alarm Messages** 7 octets
Status_Type (0x81)	
Slot_Number (0x01)	
Status_Specifier	
Status_data_ description _0	
Status_data_ description _1	
Status_partner_description	





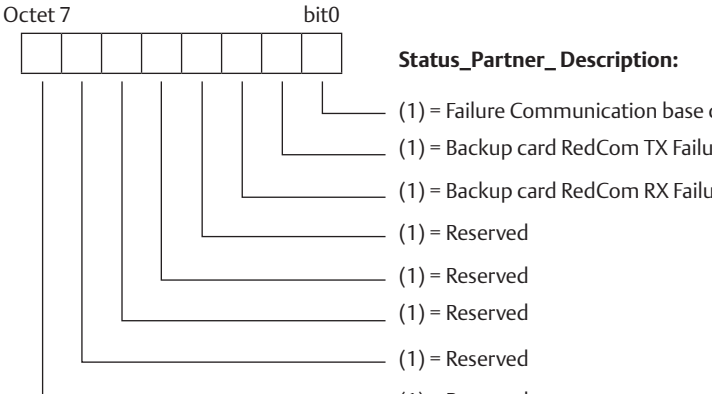
Alarm_Data_ Description_0:

(1) = Motor Thermostat
(1) = HI-HI Torque in Opening
(1) = HI-HI Torque in Closing
(1) = Actuator blocked in Opening
(1) = Actuator blocked in Closing
(1) = HI-HI Temperature
(1) = Position Sensor Failure
(1) = Speed Sensor Failure



Status_Data_Description_1:

(1) = Main Voltage Fault
(1) = K1 Contactor Failure
(1) = K2 Contactor Failure
(1) = Configuration Error
(1) = Hardware Error
(1) = Low Alkaline Battery
(1) = Lost Phase
(1) = Communication base card to Primary card failure



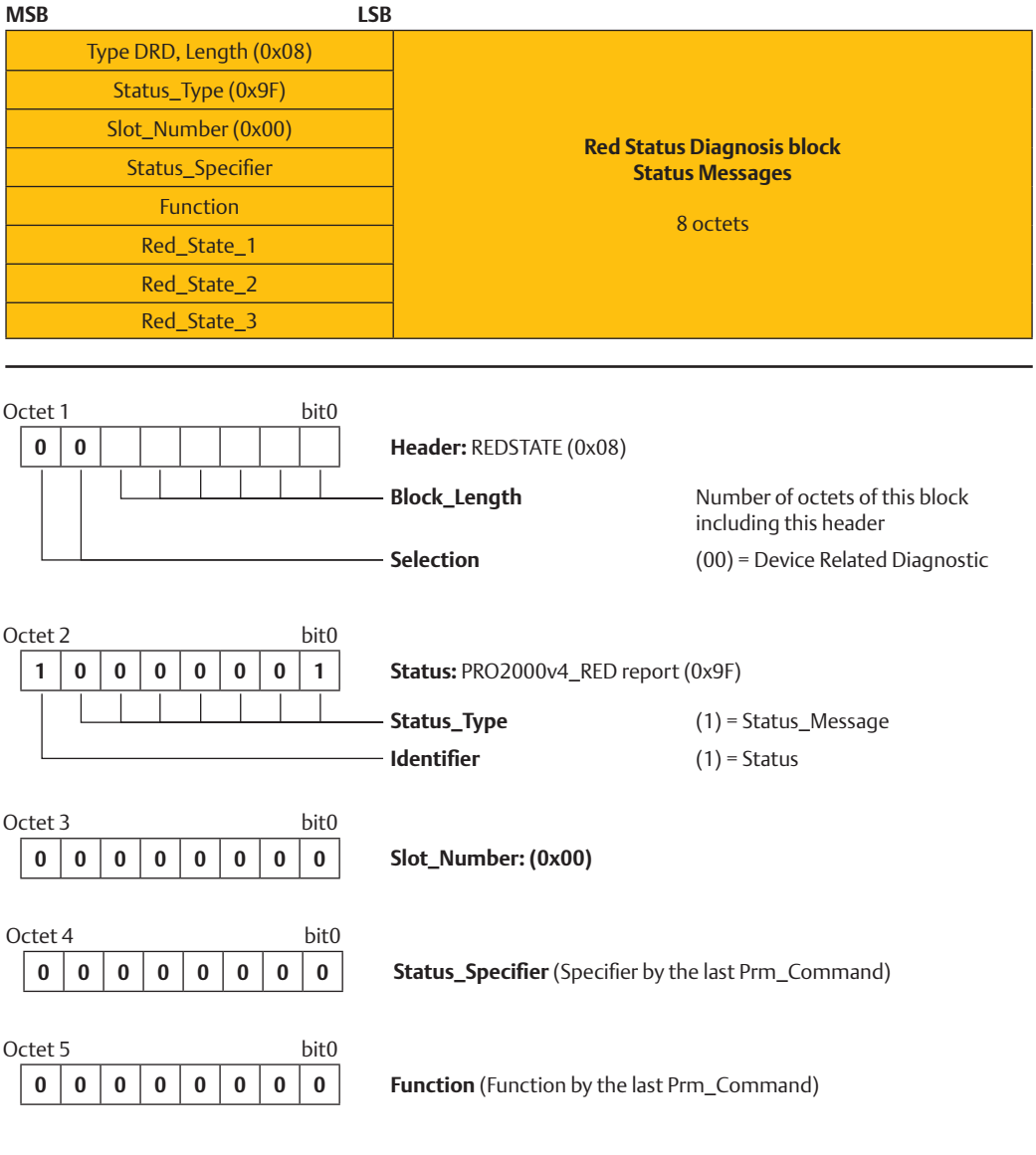
Status_Partner_ Description:

(1) = Failure Communication base card to Backup card failure
(1) = Backup card RedCom TX Failure
(1) = Backup card RedCom RX Failure
(1) = Reserved
(1) = Reserved
(1) = Reserved
(1) = Reserved
(1) = Reserved

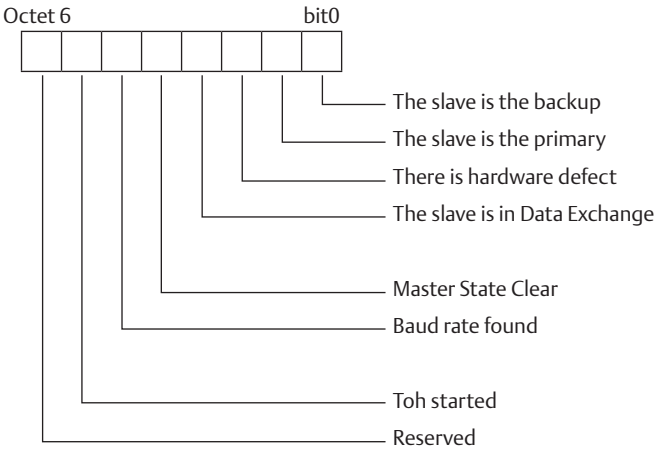
11.1.4 Extended Diagnosis: RedCom Status Message

In Figure 35, the structuring of the RedCom Status message block is presented.

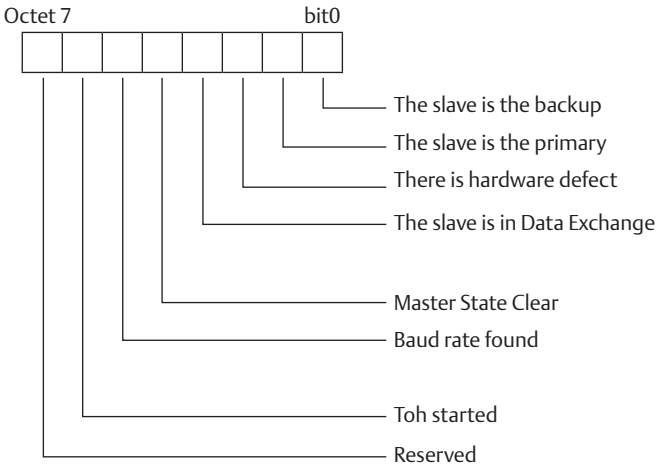
Figure 35



Red_State_1: State of Primary slave



Red_State_2: State of Backup slave



Red_State_3: State of Backup slave

Octet 8 Redundancy FSM current status (only for diagnostic)

Appendix A: Diagnosis: Card Information from PLC

The next figures display two examples of diagnostic faults available from the PLC (SIMATIC Step 7).

Figure A-1

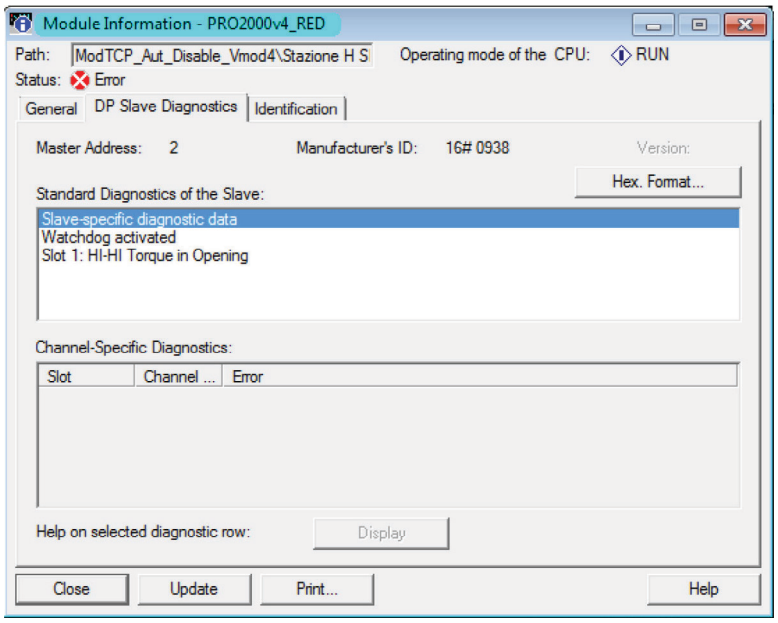
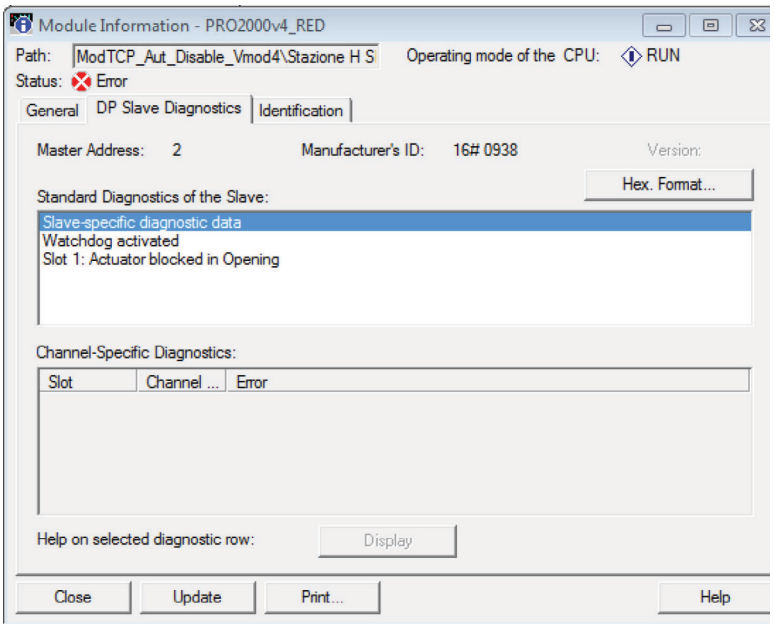
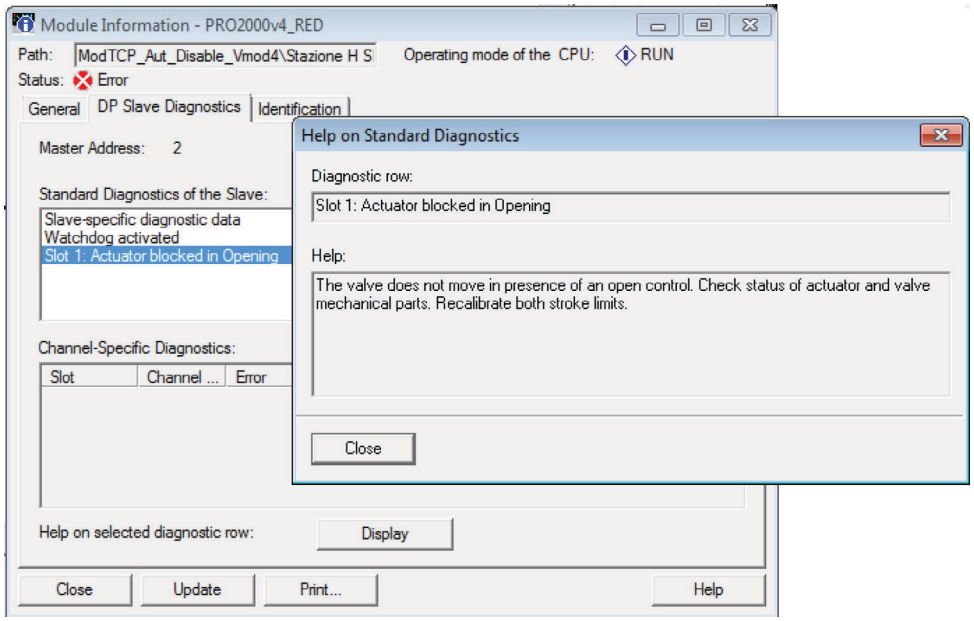


Figure A-2



In addition, by clicking on the Display button it is possible see the Help information.

Figure A-3



Appendix B: References

- Data types, Programming Languages, and Platforms PROFIBUS Guideline, Part 2, for PROFIBUS and PROFINET
  Version 1.0 September 2006
  Order No: 3.522
- PROFIBUS Technology and Application
  October 2002
- PROFIBUS Specification Slave Redundancy
  Version 1.2 November 2004
  Order No: 2.212

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