SMART RELAY
SRW 01 V4.0X

DeviceNet^{TM} Communication Manual
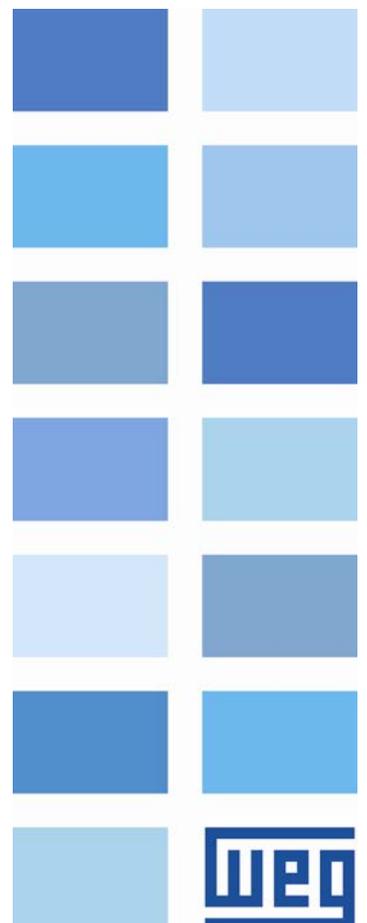
DeviceNet™ Communication Manual

Summary

ABOUT THIS MANUAL

This manual provides the necessary information for the operation of the SRW 01 smart relay using the DeviceNet™ protocol. This manual must be used together with the SRW 01 user manual.

ABBREVIATIONS AND DEFINITIONS

ASCII   American Standard Code for Information Interchange
CAN   Controller Area Network
CIP   Common Industrial Protocol
PLC   Programmable Logic Controller
HMI   Human-Machine Interface
ODVA   Open DeviceNet™ Vendor Association
CiA   CAN in Automation.
RO   Read-only parameter.
rw   Reading/writing parameter.
CFG   Configuration parameter, it can only be changed with a stopped motor.
Sys   System parameter.

NUMERICAL REPRESENTATION

Decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter 'h' after the number.

DOCUMENTS

The DeviceNet protocol for the SRW 01 was developed based on the following specifications and documents:

Document	Version	Source
CAN Specification	2.0	CiA
Volume One Common Industrial Protocol (CIP) Specification	3.2	ODVA
Volume Three DeviceNet Adaptation of CIP	1.4	ODVA

In order to obtain this documentation, consult ODVA, which is nowadays the organization that keeps, publishes and updates the information related to the DeviceNet™ network.

DeviceNet™ is trademark of Open DeviceNet Vendor Association (ODVA).

1 INTRODUCTION TO THE DEVICENET COMMUNICATION

In order to operate the SRW 01 smart relay in a DeviceNet network, it is necessary to know the manner this communication is performed. Therefore, this section brings a general description of the DeviceNet protocol operation, containing the functions used by the SRW 01. Refer to the DeviceNet documentation indicated on the previous section for a detailed description of the protocol.

1.1   CAN

DeviceNet is a network based on CAN, i.e., it uses CAN telegrams for exchanging data in the network.

The CAN protocol is a serial communication protocol that describes the services of layer 2 of the ISO/OSI model (data link layer)[1]. This layer defines the different types of telegrams (frames), the error detection method, the validation and arbitration of messages.

1.1.1 Data Frame

CAN network data is transmitted by means of a data frame. This frame type is composed mainly by an 11 bit[2] identifier (arbitration field), and by a data field that may contain up to 8 data bytes.

Identifier	8 data bytes							
11 bits	byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

1.1.2 Remote Frame

Besides the data frame, there is also the remote frame (RTR frame). This type of frame does not have a data field, but only the identifier. It works as a request, so that another network device transmits the desired data frame.

1.1.3 Access to the Network

Any device in a CAN network can make an attempt to transmit a frame to the network in a certain moment. If two devices try to access the network simultaneously, the one that sends the message with the highest priority will be able to transmit. The message priority is defined by the CAN frame identifier, the smaller the value of this identifier, the higher the message priority. The telegram with the identifier 0 (zero) is the one with the highest priority.

1.1.4 Error Control

The CAN specification defines several error control mechanisms, which makes the network very reliable and with a very low undetected transmission error rate. Every network device must be able to identify the occurrence of these errors, and to inform the other elements that an error was detected.

A CAN network device has internal counters that are incremented every time a transmission or reception error is detected, and are decremented when a telegram is successfully transmitted or received. If a considerable amount of errors occurs, the device can be led to the following states:

☑ *Warning*: when the counter exceeds a defined limit, the device enters the *warning* state, meaning the occurrence of a high error rate.
☑ *Error Passive*: when this value exceeds a higher limit, the device enters the *error passive* state, and it stops acting in the network when detecting that another device sent a telegram with an error.
☑ *Bus Off:* finally, we have the *bus off* state, in which the device will not send or receive telegrams any more.

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[1] In the CAN protocol specification, the ISO11898 standard is referenced as the definition of the layer 1 of this model (physical layer).
[2] The CAN 2.0 specification defines two data frame types, standard (11 bit) and extended (29 bit). For the SRW 01 DeviceNet protocol, only the standard frames are accepted.

1.1.5 CAN and DeviceNet

Only the definition of how to detect errors, create and transmit a frame, are not enough to define a meaning for the data transmitted via the network. It is necessary to have a specification that indicates how the identifier and the data must be assembled and how the information must be exchanged. Thus, the network elements can interpret the transmitted data correctly. In that sense, the DeviceNet specification defines exactly how to exchange data among the devices and how every one must interpret these data.

There are several other protocols based on CAN, as CANopen, J1939, etc., which do also use CAN frames for the communication. However, those protocols cannot be used together in the same network.

1.2 DEVICENET

The next sections present, in a succinct form, the DeviceNet protocol.

1.2.1 Introduction

Introduced in 1994, DeviceNet is an implementation of the Common Industrial Protocol (CIP) for industrial communication networks. Developed originally by Allen-Bradley, it had its technology transferred to the ODVA that, since then, keeps, publishes and promotes DeviceNet and other networks based on the CIP[3] protocol. Furthermore, it uses the Controller Area Network (CAN) protocol for the data link and access to the medium, layers 2 and 1 of the OSI/ISO model, respectively.

Used mainly for the connection of industrial controllers and I/O devices, the protocol follows the model producer-consumer, supports multiple communication modes and has priority between messages.

It is a system that can be configured to operate in master-slave architecture as well as in a distributed point-to-point architecture. Besides, it defines two kinds of messages, I/O (process data) and explicit (configuration and parameterization). It also has mechanisms to detect duplicated addresses and for node isolation in case of critical faults.

A DeviceNet network can have up to 64 devices, addressed from 0 to 63. Any of them can be used. There is no restriction, although the 63 should be avoided because it is usually used for commissioning.

1.2.2 Physical Layer

DeviceNet uses a network topology of the trunk/derivation type that allows the signal wiring as well as the power wiring to be present in the same cable. This power is supplied by a power supply connected directly to the network, which feeds the CAN transceivers of the nodes, and has the following characteristics:

- ☑ 24 Vdc;
- ☑ DC output isolated from the AC input;
- ☑ Current capacity compatible with the installed equipment.

The used Baud rate depends on the size (cable length) of the network, as showed in the table below.

Table 1.1 - Network size x Baud rate

Baud Rate	Network Size	Derivation	
		Maximum	Total
125kbit/s	500m (1640.41 ft)	6m (19.68 ft)	156m (511.81 ft)
250kbit/s	250m (820.21 ft)		78m (255.9 ft)
500kbit/s	100m (328.08 ft)		39m (127.95 ft)

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[3] CIP actually represents a family of networks. DeviceNet, EtherNet/IP and ControlNet use CIP in the application layer. The difference among them is primordially in the data link and physical layers.

Introduction to the DeviceNet Communication

In order to avoid reflections in the line, it is recommended the installation of termination resistors at the line extremes, because the absence of them may cause intermittent errors. This resistor must have the following characteristics, according to the protocol specification:

☑ 121 Ω;
☑ 0,25 W;
☑ 1% tolerance.

For DeviceNet, several types of connectors can be used, sealed ones as well as open ones. The definition of the type to be used depends on the application and on the equipment operation environment. The SRW 01 uses a *plug-in* type connector, whose pinout is showed in the section 2. For a complete description of the connectors used with DeviceNet, consult the protocol specification.

1.2.3 Data Link Layer

The DeviceNet data link layer is defined by the CAN specification, which defines two possible states; dominant (logic level 0) and recessive (logic level 1). A node can bring the network to the dominant state if it transmits any information. Thus, the bus will only be in the recessive state if there where no transmitting nodes in the dominant state.

CAN uses the CSMA/NBA to access the physical medium. This means that a node, before transmitting, must verify if the bus is free. In case it is, then the node can initiate the transmission of its telegram. In case it is not, then the node must await. If more than one node accesses the network simultaneously, a priority mechanism takes action to decide which one will have priority over the others. This mechanism is not destructive, i.e., the message is preserved even if there is a collision between two or more telegrams.

CAN defines four types of telegrams (data, remote, overload and error). Among them, DeviceNet uses only the data frame and the error frame.

Data is moved using the data frame. This frame structure is showed in the Figure 1.1.

Errors, however, are indicated by means of the error frames. CAN has a very robust error verification and confinement. This assures that a node with problems does not impair the communication in the network.

For a complete description of the errors, consult the CAN specification.

Interframe Space	1 bit	11 bits	1 bit	6 bits	0-8 bytes	15 bits	1 bit	1 bit	1 bit	7 bits	≥ 3 bits
	Start of Frame	Identifier	RTR bit	Control Field	Data Field	CRC Sequence	CRC Delimiter	ACK Slot	ACK Delimiter	End of Frame	Interframe Space
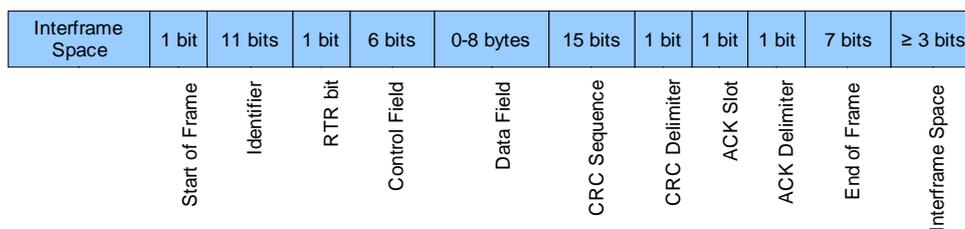
Figure 1.1 - *CAN data frame*

1.2.4 Network and Transport Layer

DeviceNet requires that a connection be established before data exchange with the device takes place. In order to establish this connection each DeviceNet node must implement the *Unconnected Message Manager* (UCMM) or the *Group 2 Unconnected Port*. These two allocation mechanisms use messages of the explicit type to establish a connection, which will then be used for process data exchange between one node and the other. This data exchange uses messages of the I/O type (refer to section 1.2.7).

The DeviceNet telegrams are classified in groups, which define specific functions and priorities. Those telegrams use the identifier field (11 bits) of the CAN data frame to uniquely identify each one of the messages, thus assuring the CAN priority mechanism.

A DeviceNet node can be a client, a server or both. Furthermore, clients and servers can be producers and/or consumers of messages. In a typical client node, for instance, its connection will produce requests and will consume

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answers. Other client or server connections will only consume messages. In other words, the protocol allows several connection possibilities among the devices.

The protocol also has a resource for detection of nodes with duplicated addresses (Mac ID). Avoiding that duplicated addresses occur is, in general, more efficient than trying to locate them later.

1.2.5 Application Layer – CIP Protocol

In the application layer, DeviceNet uses the Common Industrial Protocol (CIP). It is a protocol strictly orientated to objects, used also by ControlNet and EtherNet/IP. In other words, it is independent from the physical medium and from the data link layer. The Figure 1.2 presents the structure of this protocol.

The CIP has two main purposes:

☑   Transport of I/O devices control data.
☑   Transport of configuration and diagnosis information of the system being controlled.
A DeviceNet node (master or slave) is then molded by a set of CIP objects, which encapsulate data and services, thus determining its behavior.

There are obligatory objects (each device must have) and optional objects. Optional objects are those that mold the device according to the category (called profile) to which they belong, as: AC/DC drive, bar code reader or pneumatic valve. For being different, each one of them will contain a group of also different objects.

For more information refer to the DeviceNet specification. It presents the complete list of devices already standardized by the ODVA, as well as the objects that compose them.

1.2.6 Configuration File

Every DeviceNet node has a configuration file associated[4]. This file contains important information about the device operation and must be registered in the network configuration software.
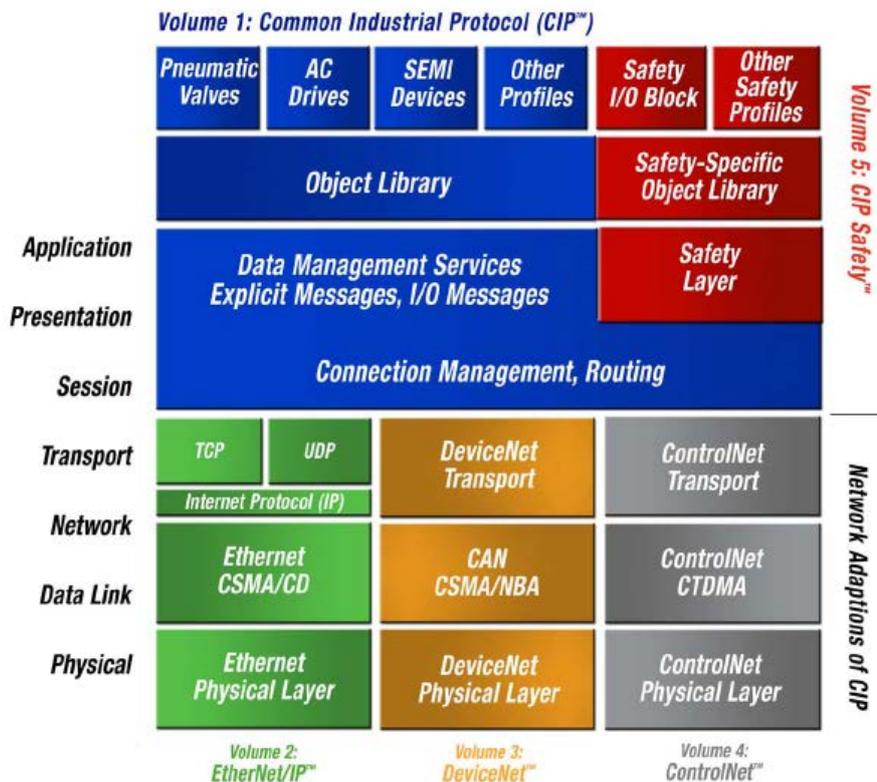
Figure 1.2 – *Layer structure of the CIP protocol*

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[4] Known as EDS file.

1.2.7 Communication Modes

The DeviceNet protocol presents two basic types of messages, I/O and explicit. Each one of them is adequate to a specific kind of data, as described below:

☑ **I/O**: It is a kind of synchronous telegram dedicated to the movement of priority data between one producer and one or more consumers. They are divided according to the data exchange method. The main types are:

- *Polled:* It is a communication method where the master sends one telegram to each of the slaves of its list (*scan list*). As soon as receiving the request, the slave responds promptly to the request from the master. This process is repeated until all be consulted, restarting the cycle.

- *Bit-strobe:* It is a communication method where the master sends to the network a telegram containing 8 data bytes. Each bit from those 8 bytes represents a slave that, if addressed, responds according to the programmed.

- *Change of State:* It is a communication method where the data exchange between master and slave occurs only when changes in the monitored/controlled values happened, until a certain time limit. When this limit is reached, the transmission and reception will occur even if there were no changes. The configuration of this time variable is done in the network configuration program.

- *Cyclic:* It is another communication method very similar to the previous one. The only difference stays in the production and consume of messages. In this type, every data exchange occurs in regular time intervals, whether or not they had been changed. This time period is also adjusted in the network configuration software.

☑ **Explicit**: It is a kind of general purpose telegram and without priority. It is mainly used for asynchronous tasks like the parameter settings and the configuration of the equipment.

1.2.8 Set of Predefined Master/Slave Connections

DeviceNet uses fundamentally a point-to-point message model. However, it is quite common to use a predefined communication model based on the master/slave mechanism.

This model uses a simplified message movement of the I/O type, very common in control applications. An advantage of this method is that the necessary requests to run it are generally less, if compared to the UCMM. Even simple devices with limited resources (memory, 8 bit processor) are capable of executing the protocol.

2 ACCESSORY KIT

In order to make the DeviceNet communication possible with the SRW 01 smart relay, it is necessary to use a DeviceNet communication kit, as described below. Information on the installation of this module in the relay can be obtained in the installation guide that comes with the kit.

2.1 DEVICENET INTERFACE

2.1.1 DeviceNet Kit
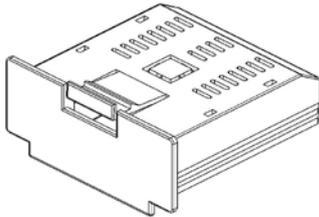
☑ Composed by the DeviceNet communication board (figure at the left) plus the installation guide.
☑ The interface is electrically isolated and with differential signal, which grants more robustness against electromagnetic interference.
☑ External 24V supply via the DeviceNet network cable.

2.1.2 Connector Pinout

The relay uses an 8-wire plug-in connector (XC2) with the following pinout for the DeviceNet communication:
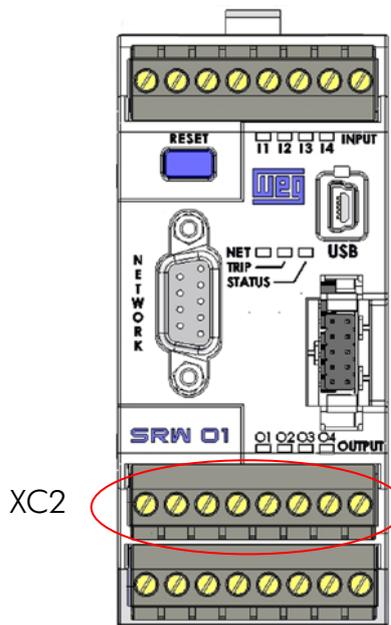
Table 2.1 — XC2 connector pinout for DeviceNet interface

Pin	Signal	Function
A	A	Signal A (Profibus/Modbus)
B	B	Signal B (Profibus/Modbus)
PE	PE	Protective ground
BK	V-	Power supply negative pole
BU	CAN_L	CAN_L communication signal
SH	Shield	Cable shield
WH	CAN_H	CAN_H communication signal
RD	V+	Power supply positive pole

⚠ **ATTENTION!**
The pins A and B are for the exclusive use of the Profibus protocol. Therefore, when the relay uses the DeviceNet communication board, they must remain disconnected.

⚠ **ATTENTION!**
The pin PE must be obligatorily connected to a protective ground.

2.1.3 Power Supply

The DeviceNet Interface for the SRW 01 needs an external power supply between the pins BK and RD of the network connector (XC2). In order to avoid problems of potential difference among the network devices, it is recommended that the network be supplied at only one point, and that the power supply be taken to all the devices through the cable. If more than one power supply is necessary, they must be referenced to the same point. The individual consumption and input voltage data are presented in the next table.

Table 2.2 – *Power supply characteristics for the CAN/DeviceNet interface*

Power supply (Vdc)		
Minimum	Maximum	Recommended
11	30	24
Current (mA)		
Typical		Maximum
30		50

2.2 CONNECTION WITH THE NETWORK

For the connection of the relay using the DeviceNet interface the following points must be observed:

☑ The use of cables specific for CAN/DeviceNet networks is recommended.
☑ Grounding of the cable shield at only one point, thus avoiding current loops. This point is usually at the power supply. If there is more than one power supply, only one of them must be connected to the protective earth.
☑ The termination resistors must be installed only at extremes of the main bus, even if there are derivations.
☑ The network power supply must be able to deliver enough current to feed all the equipment transceivers. The SRW 01 DeviceNet communication board consumes approximately 30mA.

2.3 MODULE CONFIGURATION

In order to configure the DeviceNet module follow the steps indicated below:

☑ With the relay powered off install the DeviceNet communication board in the slot located at the bottom of the equipment.
☑ Make sure it is properly fitted into the slot.
☑ Power up the relay.
☑ Verify the contents of the parameter P084 making sure that the communication module was correctly recognized (P084 = 2). If necessary, refer to the installation guide and to the user manual.
☑ Adjust the address of the relay in the network through the parameter P725.
   - Valid values: 0 to 63.
☑ Set the baud rate in P726. Valid values:
   - 0 = 125 kbit/s
   - 1 = 250 kbit/s
   - 2 = 500 kbit/s
   - 3 = Autobaud
☑ Configure the used data profile at the parameter P727, ODVA or WEG.
☑ Configure the number of input and output words at the parameters P728 and P734 respectively. The very same number of words must be adjusted at the network master. For more details refer to the part regarding the parameter P202 at the section 3.
☑ Cycle the power of the SRW 01, so that the changes become effective.
☑ Connect the network cable wires at the XC2 terminal strip (refer to the section 2.1.2).
☑ Register the configuration file (EDS file) in the network configuration software.
☑ Add the SRW 01 to the scan list of the master.
☑ In the network configuration *software*, choose a method of data exchange with the master, i.e., *polled, change of state or cyclic*. The SRW 01 DeviceNet module supports all these I/O data types, besides the *explicit* (acyclic data).
☑ If everything is configured correctly the parameter P719 will indicate the "*Online* Not Connected" or "*Online* Connected" state. Observe also the parameter that indicates the network master status, P720.

There will only be effective data exchange when the master status is *Run*. In this situation the NET LED must be either flashing or in steady green.

Refer to the section 3 or to the user manual for more information on the parameters mentioned above.

2.4 ACCESS TO THE PARAMETERS

After the EDS file registration in the network configuration software, the user will get access to the equipment complete parameter list, which can be accessed via *explicit messages*.
This means that it is possible to perform the relay programming and configuration through the network configuration software.

In order to get application details of this resource, refer to the network master programming documentation (PLC, PC, etc.).

2.5 STATUS INDICATION

The indication of the SRW 01 status and errors in the DeviceNet network is done through the messages on the HMI[5] display (refer to the next section) and the bicolor NET LED located on the equipment front cover. This bicolor LED (green/red) presents information regarding the communication module itself and the communication status.

The table below shows the behavior of this LED in function of the relay status:

State	LED	Description
Device Not Powered/Not On-line	Off	☑ Communication module without supply or offline. ☑ The device did not finish the procedure to enter the network.
Device Operational and On-line, Connected	Steady green	☑ The device is in normal operation conditions, on-line and with established connections.
Device Operational and On-line, Not Connected	Flashing green	☑ The device is in normal operation conditions, on-line, but without established connections. ☑ It normally means that the device is not present in the network master scan list.
Connection Time-Out	Flashing red	☑ One or more I/O type connections went to the timed-out state (have expired).
Critical Link Failure	Steady red	☑ The device is in fault condition. ☑ An error that prevented the network communication has been detected, typically duplicated Mac ID or Bus Off. ☑ Make sure the adjusted address is not in use and verify whether the baud rate is correct.

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[5] When present.

3 RELAY PARAMETERIZATION

Next only the SRW 01 smart relay parameters related to the DeviceNet communication will be presented.
The detailed description of this parameter is found in the SRW 01 User Manual.

P202 – Operation Mode

Adjustable range:	0 = Transparent 1 = Overload Relay 2 = Direct Start 3 = Reverse Start 4 = Star-Delta Start 5 = Dahlander Start 6 = Pole-Changing Start 7 = PLC Mode	Factory default: 1

Properties: Sys, CFG

Description:
This parameter allows selecting the SRW 01 operation mode. The functions of digital inputs and outputs are configured automatically according to this selection.

P220 – Local/Remote Selection

Adjustable Range:	0 = Always Local 1 = Always Remote 2 = HMI key (LOC) 3 = HMI key (REM) 4 = Digital Input I3 5 = Digital Input I4 6 = Fieldbus (LOC) 7 = Fieldbus (REM) 8 = USB/Ladder	Factory default: 2

Properties: Sys, rw

Description:
This parameter defines the origin of the command that will select the SRW 01 working mode (Local/Remote) and its initial state.

P232 – Remote Command Selection

Adjustable Range:	0 = Ix 1 = HMI 2 = USB/Ladder 3 = Fieldbus	Factory default: 3

Properties: Sys, rw

Description:
It defines the origin of the remote commands.
If P232 = 3, the remote commands are controlled by the industrial network master.

P277 – Digital Output O1 Function

P278 – Digital Output O2 Function

P279 – Digital Output O3 Function

P280 – Digital Output O4 Function

P281 – Digital Output O5 Function

P282 – Digital Output O6 Function

P283 – Digital Output O7 Function

P284 – Digital Output O8 Function

Adjustable Range:	0 = Internal use (P202) 1 = Ladder 2 = Fieldbus 3 = Alarm/Fault (NO) Signal 4 = Trip/Error (NO) Signal 5 = Trip/Error (NC) Signal	Factory default: 1

Properties: Sys, CFG

Description:
They define the relay output control origin.

Internal Use: it is used according to selected operation mode (P202);
Ladder: it is used by the user program implemented in Ladder;
Fieldbus: it is used directly by the industrial network master.

Alarm/Fault (NO) Signal: it is used to signal Alarm or Fault. In case of Alarm or Fault the output is closed, remaining like this until the cause of failure is not present anymore and the reset control is set.
Trip/Error (NO) Signal: it is used to signal Trip or Error. In case of Trip or Error (Ex. No communication with the Current Measuring Unit) the output is closed, remaining this until the cause of the failure is not present anymore and the reset control is set.
Trip/Error (NC) Signal: it is used to signal Trip or Error. In case of Trip or Error (Ex. No communication with the Current Measuring Unit) the output is closed, remaining like this until the cause of the failure is not present anymore and the reset control is set.

> **NOTE!**
> It is worthwhile to remember that the availability of the digital outputs (O1-O4) depends on the used operation mode, because it is possible that one or more outputs be already pre-allocated for other functions.

P313 – Communication Error Action

Adjustable range:	0 = Only indicates fault 1 = Stops motor 2 = Stops motor and resets commands 3 = Goes to local	Factory default: 0

Properties: Sys, rw

Description:
This parameter allows selecting which action must be executed by the relay, in case that a communication error is detected.

Table 3.1 – Values for the parameter P313

Options	Description
0 = Only indicates fault	Fault indication only with no action taken. The indication of fault will be automatically removed if the fault condition is cleared and the relay status are not either TRIP or Error. If the relay status is TRIP or Error, it is mandatory to perform "error reset" in order to remove the fault indication.
1 = Stops motor	It switches the motor off, for the operation modes where this commands exists. It is necessary to perform the error reset in order to remove the indication.
2 = Stops motor and resets commands	It switches the motor off and resets the commands. It is necessary to perform the error reset in order to remove the indication.
3 = Goes to local	It changes to local mode, providing that the local/remote selection is programmed to be executed via Fieldbus. The indication of fault will be automatically removed if the fault condition is cleared and the relay status are not either TRIP or Error. If the relay status is TRIP or Error, it is mandatory to perform "error reset" in order to remove the fault indication.

For the CAN interface used with the DeviceNet protocol, the following events are considered communication errors:

☑ Error E0061: B*us off.*
☑ Error E0063: Without power supply at the DeviceNet interface.
☑ Error E0064: Idle network master.
☑ Error E0067: Timeout in one or more I/O connections has occurred.

The description of these errors is presented in the section 4.

P703 – Bus Off Reset

Adjustable range:	0 = Manual 1 = Automatic	**Factory default:** 1

Properties: Sys, CFG

Description:
It allows programming the relay behavior when detecting a bus off error in the CAN interface.

Table 3.2 – Values for the parameter P703

Options	Description
0 = Manual Reset	If *bus off* occurs, the E061 error will be indicated on the HMI, the action programmed in parameter P313 will be executed and the communication will be disabled. In order that the relay communicates again through the CAN interface, it will be necessary to cycle the power of the SRW 01.
1= Automatic Reset	If *bus off* occurs, the communication will be reinitiated automatically and the error will be ignored. In this case the error will not be indicated on the HMI and the relay will not execute the action programmed in P313.

P705 – CAN Controller Status

Adjustable range:	0 = Inactive 1 = Autobaud 2 = Active CAN Interface 3 = *Warning* 4 = *Error Passive* 5 = *Bus Off* 6 = No Bus Power	Factory default: -

Properties: RO

Description:
It allows identifying if the CAN interface board is properly installed and if the communication presents errors.

Table 3.3 – Values for the parameter P705

Options	Description
0 = Inactive	Inactive CAN interface. It occurs when the relay does not have the DeviceNet board installed or soon after the relay is energized / reinitiated.
1 = Autobaud	It indicates that the autobaud detection routines are being executed.
2 = Active CAN Interface	Can interface is active and without errors.
3 = *Warning*	The CAN controller has reached the warning state.
4 = *Error Passive*	The CAN controller has reached the *error passive* state.
5 = *Bus Off*	The CAN controller has reached the *bus off* state.
6 = No Bus Power	The CAN interface does not have power supply between the pins BK and RD of the XC2 connector.

P706 – Received CAN Telegram Counter

Adjustable range:	0 to 65535	Factory default: -

Properties: RO

Description:
This parameter works as a cyclic counter that is incremented every time a CAN telegram is received. It gives a feedback to the operator if the device is able to communicate with the network. This counter is reset every time the relay is switched on or when the maximum limit of the parameter is reached.

P707 – Transmitted CAN Telegram Counter

Adjustable range:	0 to 65535	Factory default: -

Properties: RO

Description:
This parameter works as a cyclic counter that is incremented every time a CAN telegram is transmitted. It gives a feedback to the operator if the device is able to communicate with the network. This counter is reset every time the relay is switched on or when the maximum limit of the parameter is reached.

P708 – Bus Off Error Counter

Adjustable range:	0 to 65535	Factory default: -

Properties: RO

Description:
It is a cyclic counter that indicates the number of times the relay entered the bus off state in the CAN network. This counter is reset every time the relay is switched on or when the maximum limit of the parameter is reached.

P709 – Lost CAN Message Counter

Adjustable range: 0 to 65535   **Factory default:** -

Properties: RO

Description:

It is a cyclic counter that indicates the number of messages received by the CAN interface that could not be processed by the relay. In case that the number of lost messages is frequently incremented, it is recommended to reduce the baud rate used in the CAN network. This counter is reset every time the relay is switched on or when the maximum limit of the parameter is reached.

P719 – DeviceNet Network Status

Adjustable range:
0 = *Offline*
1 = *Online,* Not Connected
2 = *Online,* Connected
3 = Timed-out Connection
4 = Connection Failure
5 = Auto-baud

Factory default: -

Properties: RO

Description:

It indicates the status of the DeviceNet network. The next table presents a brief description of these states.

Table 3.4 – Values for the parameter P719

Status	Description
Offline	Device without power supply or not online. Communication cannot be established,
Online, Not Connected	Device online, but not connected. The slave has successfully completed the MacID verification procedure. This means that the configured baud rate is correct (or it has been detected correctly in case of autobaud) and that there are no other network nodes with the same address. However, there is no communication with the master yet in this stage.
Online, Connected	The device is operational and in normal conditions. The master has allocated a set of I/O type connections with the slave. In this stage the effective exchange of data by means of I/O type connections occurs.
Timed-out Connection	One or more I/O type connections have expired.
Connection Failure	It indicates that the slave was not able to enter the network due to addressing problems or due to the occurrence of bus off. Make sure the configured address is not used by other device, verify if the chosen baud rate is correct and make sure there are no installation problems.
Autobaud	The equipment is executing the autobaud mechanism routines.

P720 – DeviceNet Master Status

Adjustable range:
0 = *Run*
1 = *Idle (Prog)*

Factory default: -

Properties: RO

Description:

It indicates the DeviceNet network master status. It may be in operation mode (Run) or in configuration mode (Prog).

When in Run, reading and writing telegrams are normally processed and updated by the master. When in Prog, only the reading telegrams from the slaves are updated by the master. Writing, in this case, remains disabled.

P725 – Communication Board Address

Adjustable range:	0 to 255	**Factory default:** 63

Properties:	Sys, CFG

Description:

It allows programming the address relay communication board. It is necessary that each device in the network has an address different from the others. The valid addresses for this parameter depend on the used protocol:

Modbus → valid addresses: 1 to 247.
DeviceNet → valid addresses: 0 to 63.
Profibus → valid addresses: 1 to 125.

If this parameter is changed, it becomes valid only after cycling the power of the relay.

P726 – DeviceNet/Modbus Board Baud Rate

Adjustable range:	0 = 125 Kbit/s 4,8 Kbit/s 1 = 250 Kbit/s 9,6 Kbit/s 2 = 500 Kbit/s 19,2 Kbit/s 3 = Autobaud/ 38,4 Kbit/s	**Factory default:** 3

Properties:	Sys, CFG

Description:

It allows programming the desired baud rate for the DeviceNet and Modbus boards, in bits per second. This rate must be the same for all the devices connected to the network. The values at the left (above) refer exclusively to the DeviceNet network. When the option "Autobaud" is selected, the SRW 01 will adjust itself automatically to the actual network baud rate.

However, in order that this mechanism works it is necessary that two or more devices be actively communicating in the network.

After a successful detection, the baud rate parameter (P726) changes automatically to the detected rate. In order to execute the autobaud function again, it is necessary to change the parameter P726 to "Autobaud".

If this parameter is changed, it becomes valid only after cycling the power of the relay.

P727 – DeviceNet Data Profile

Adjustable range:	0 = ODVA 1 = WEG	**Factory default:** 0

Properties:	Sys, CFG

Description:

It allows selecting the data profile to be used by the relay, i.e., the data format for the equipment operation via DeviceNet network. The ODVA option represents the standard defined in the ODVA *Motor Overload Profile*. In this profile the SRW 01 implements the 2/50 instances (*Basic Overload*). The data size of this instance is of only 1 byte for input and 1 byte for output.

> **NOTE!**
> If the parameter P727 is changed, it will only become effective after cycling the power of the relay.

The monitoring and control data format for this profile is presented below.
0 = Data format for the ODVA *Basic Overload* (1 byte) instances:
The option 0 (ODVA) of this parameter selects the I/O instances known as *Basic Overload*. These instances represent the simplest equipment operation interface according to the *Motor Overload Profile*. The data mapping is showed below.

Relay Parameterization

Monitoring (Input)

Instance	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
50								Faulted

Bits (Byte 0)	Values
Bit 0 Faulted	**0:** The relay is not in fault state **1:** A fault has been registered by the relay **Note:** the fault number can be read through the parameter P016 – Current Error

> **NOTE!**
> Fault, in this context, means error, trip or alarm.

Control (Output)

Instance	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2						Fault Reset		

Bits (Byte 0)	Values
Bit 2 Fault Reset	**0:** No function **1:** If the relay is in fault (trip) condition, reset it

> **NOTE!**
> Fault, in this context, means error, trip or alarm.

1 = Data format for WEG instances:
The option 1 (WEG) of this parameter selects the WEG data Profile, which is no more than the equipment operation interface via network according to the operation mode chosen at the parameter P202. The parameters P729 and P735 present the format of this data for each of the operation modes.

P728 - Number of Words from the Slave to the Master

Adjustable range:	1 to 12	Factory default: 1

Properties: Sys, rw

Description:
It allows selecting the number of input words exchanged with the master. Each word has the following meaning:

1st Word: it represents the status word which depends on the chosen operation mode. In order to facilitate the diagnosis, the content of this word is shown at the parameter P729.
2nd to 12nd Word: It is a content sent to the master, programmable via parameters P730 to P733, and P742 to P748.

> **NOTE!**
> If the parameter P728 is changed, it will only become effective after cycling the power of the relay.

P729 – Status Word #1

Adjustable range:	0000h – FFFFh	Factory default: -

Properties: RO

Description:

It allows monitoring the relay status. The content of this parameter is transmitted to the DeviceNet network master, always at the first input word. The format of this word depends on the SRW 01 operation mode, programmed at the parameter P202.

Transparent Mode (P202 = 0):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	O3 output state	O2 output state	O1 output state	I4 input state	I3 input state	I2 input state	I1 input state	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0:** the relay is not in error condition **1:** the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the alarm/fault condition **1:** the relay is in the alarm/fault condition **Note:** The alarm/fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0:** motor Off **1:** Motor On
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 I1 Input state	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 I2 input state	**0:** I2 digital input is deactivated **1:** I2 digital input is activated
Bit 7 I3 input state	**0:** I3 digital input is deactivated **1:** I3 digital input is activated
Bit 8 I4 input state	**0:** I4 digital input is deactivated **1:** I4 digital input is activated
Bit 9 O1 output state	**0:** O1 digital output is deactivated **1:** O1 digital output is activated
Bit 10 O2 output state	**0:** O2 digital output is deactivated **1:** O2 digital output is activated
Bit 11 O3 output state	**0:** O3 digital output is deactivated **1:** O3 digital output is activated
Bit 12 O4 output state	**0:** O4 digital output is deactivated **1:** O4 digital output is activated
Bits 13 to 15	Reserved

Relay Parameterization

Overload Relay Mode (P202 = 1):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	O3 output state	Trip – NC (O2 output)	Trip – NO (O1 output)	I4 input state	I3 input state	I2 input state	I1 input state	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0**: the relay is not in error condition **1**: the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0**: the relay is not in the trip condition **1**: the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0**: the relay is not in the Alarm/Fault condition **1: the** relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0**: motor Off **1**: Motor On
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode
Bit 5 I1 input state	**0**: I1 digital input is deactivated **1**: I1 digital input is activated
Bit 6 I2 input state	**0**: I2 digital input is deactivated **1**: I2 digital input is activated
Bit 7 I3 input state	**0**: I3 digital input is deactivated **1**: I3 digital input is activated
Bit 8 I4 input state	**0**: I4 digital input is deactivated **1**: I4 digital input is activated
Bit 9 Trip - NC	**0**: O1 digital output is deactivated **1**: O1 digital output is activated
Bit 10 Trip - NO	**0**: O2 digital output is deactivated **1**: O2 digital output is activated
Bit 11 O3 output state	**0**: O3 digital output is deactivated **1**: O3 digital output is activated
Bit 12 O4 output state	**0**: O4 digital output is deactivated **1**: O4 digital output is activated
Bits 13 to 15	Reserved

Direct Start Mode (P202 = 2):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	O3 output state	O2 output state	Contactor operation (O1 output)	I4 input state	Check Back (I3 input)	Button ON (I2 input)	Button OFF (I1 input)	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0**: the relay is not in error condition **1**: the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error

Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the Alarm/Fault condition **1:** the relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0:** motor Off **1:** Motor On
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 Button OFF	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 Button ON	**0:** I2 digital input is deactivated **1:** I2 digital input is activated
Bit 7 Check Back	**0:** I3 digital input is deactivated **1:** I3 digital input is activated
Bit 8 I4 input state	**0:** I4 digital input is deactivated **1:** I4 digital input is activated
Bit 9 Contactor operation	**0:** O1 digital output is deactivated **1:** O1 digital output is activated
Bit 10 O2 output state	**0:** O2 digital output is deactivated **1:** O2 digital output is activated
Bit 11 O3 output state	**0:** O3 digital output is deactivated **1:** O3 digital output is activated
Bit 12 O4 output state	**0:** O4 digital output is deactivated **1:** O4 digital output is activated
Bits 13 to 15	Reserved

Reverse Start Mode (P202 = 3):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	O3 output state	Reverse Contactor operation (O2 output)	Forward Contactor operation (O1 output)	Check Back (I4 input)	Reverse button ON (I3 input)	Forward button ON (I2 input)	Button OFF (I1 input)	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0:** the relay is not in error condition **1:** the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the Alarm/Fault condition **1:** the relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0:** motor Off **1:** Motor On
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 Button OFF	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 Forward button ON	**0:** I2 digital input is deactivated **1:** I2 digital input is activated
Bit 7 Reverse button ON	**0:** I3 digital input is deactivated **1:** I3 digital input is activated

Relay Parameterization

Bit 8 Check Back	**0:** I4 digital input is deactivated **1:** I4 digital input is activated
Bit 9 Forward Contactor operation	**0:** O1 digital output is deactivated **1:** O1 digital output is activated
Bit 10 Reverse Contactor operation	**0:** O2 digital output is deactivated **1:** O2 digital output is activated
Bit 11 O3 output state	**0:** O3 digital output is deactivated **1:** O3 digital output is activated
Bit 12 O4 output state	**0:** O4 digital output is deactivated **1:** O4 digital output is activated
Bits 13 to 15	Reserved

Star-Delta Starter (P202 = 4):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	K3 Star Contactor operation (O3 output)	K2 Delta Contactor operation (O2 output)	K1 Contactor operation (O1 output)	Check Back K1-K3 (I4 input)	Check Back K1-K2 (I3 input)	Button ON (I2 input)	Button OFF (I1 input)	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0:** the relay is not in error condition **1:** the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the Alarm/Fault condition **1:** the relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0:** motor Off **1:** Motor On
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 Button OFF	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 Button ON	**0:** I2 digital input is deactivated **1:** I2 digital input is activated
Bit 7 Check Back K1-K2	**0:** I3 digital input is deactivated **1:** I3 digital input is activated
Bit 8 Check Back K1-K3	0: I4 digital input is deactivated 1: I4 digital input is activated
Bit 9 K1 Contactor operation	**0:** O1 digital output is deactivated **1:** O1 digital output is activated
Bit 10 K2 - Delta Contactor operation	**0:** O2 digital output is deactivated **1:** O2 digital output is activated
Bit 11 K3 - Star Contactor operation	**0:** O3 digital output is deactivated **1:** O3 digital output is activated
Bit 12 O4 output state	**0:** O4 digital output is deactivated **1:** O4 digital output is activated
Bits 13 to 15	Reserved

Dahlander Starter (P202 = 5):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	K3 High speed Contactor operation (O3 output)	K2 High speed Contactor operation (O2 output)	K1 Low speed Contactor operation (O1 output)	Check Back (I4 input)	Low speed START button (I3 input)	High speed START button (I2 input)	Button OFF (I1 input)	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0:** the relay is not in error condition **1:** the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the Alarm/Fault condition **1:** the relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0:** motor Off **1:** Motor On
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 Button OFF	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 High speed START button	**0:** I2 digital input is deactivated **1:** I2 digital input is activated
Bit 7 Low speed START button	**0:** I3 digital input is deactivated **1:** I3 digital input is activated
Bit 8 Check Back	0: I4 digital input is deactivated 1: I4 digital input is activated
Bit 9 K1- Low speed Contactor operation	**0:** O1 digital output is deactivated **1:** O1 digital output is activated
Bit 10 K2 - High speed Contactor operation	**0:** O2 digital output is deactivated **1:** O2 digital output is activated
Bit 11 K3 - High speed Contactor operation	**0:** O3 digital output is deactivated **1:** O3 digital output is activated
Bit 12 O4 output state	**0:** O4 digital output is deactivated **1:** O4 digital output is activated
Bits 13 to 15	Reserved

Pole-Changing Starter (P202 = 6):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	O3 output state	K1 High speed Contactor operation (O2 output)	K2 Low speed Contactor operation (O1 output)	Check Back K1 – K2 (I4 input)	Low speed START button (I3 input)	High speed START button (I2 input)	Button OFF (I1 input)	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Relay Parameterization

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0:** the relay is not in error condition **1:** the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the Alarm/Fault condition **1:** the relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3 Motor On	**0:** motor Off **1:** motor On
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 Button OFF	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 High speed START button	**0:** I2 digital input is deactivated **1:** I2 digital input is activated
Bit 7 Low speed START button	**0:** I3 digital input is deactivated **1:** I3 digital input is activated
Bit 8 Check Back K1-K2	0: I4 digital input is deactivated 1: I4 digital input is activated
Bit 9 K2- Low speed Contactor operation	**0:** O1 digital output is deactivated **1:** O1 digital output is activated
Bit 10 K1 - High speed Contactor operation	**0:** O2 digital output is deactivated **1:** O2 digital output is activated
Bit 11 O3 output state	**0:** O3 digital output is deactivated **1:** O3 digital output is activated
Bit 12 O4 output state	**0:** O4 digital output is deactivated **1:** O4 digital output is activated
Bits 13 to 15	Reserved

PLC Mode (P202 = 7):

Monitoring (Input)

Bits	15 to 13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	O4 output state	O3 output state	O2 output state	O1 output state	I4 input state	I3 input state	I2 input state	I1 input state	Remote Mode	Motor On	Alarm/Fault	Trip	Error

Bits (Byte 0 and 1)	Values
Bit 0 Error	**0:** the relay is not in error condition **1:** the relay is in error condition **Note:** The error number can be read via the parameter P016 – Current Error
Bit 1 Trip	**0:** the relay is not in the trip condition **1:** the relay is in the trip condition **Note:** The trip fault number can be read via the parameter P016 - Current Error
Bit 2 Alarm/Fault	**0:** the relay is not in the Alarm/Fault condition **1:** the relay is in the Alarm/Fault condition **Note:** The Alarm/Fault number can be read via the parameter P016 – Current Error
Bit 3	Reserved
Bit 4 Remote Mode	**0:** changes to Local Mode **1:** changes to Remote Mode
Bit 5 I1 input State	**0:** I1 digital input is deactivated **1:** I1 digital input is activated
Bit 6 I2 input State	**0:** I2 digital input is deactivated **1:** I2 digital input is activated

Bit 7 I3 input State	0: I3 digital input is deactivated 1: I3 digital input is activated
Bit 8 I4 input State	0: I4 digital input is deactivated 1: I4 digital input is activated
Bit 9 O1 output state	0: O1 digital output is deactivated 1: O1 digital output is activated
Bit 10 O2 output state	0: O2 digital output is deactivated 1: O2 digital output is activated
Bit 11 O3 output state	0: O3 digital output is deactivated 1: O3 digital output is activated
Bit 12 O4 output state	0: O4 digital output is deactivated 1: O4 digital output is activated
Bits 13 to 15	Reserved

P730 – DeviceNet Reading Word #2

P731 – DeviceNet Reading Word #3

P732 – DeviceNet Reading Word #4

P733 – DeviceNet Reading Word #5

P742 – DeviceNet Reading Word #6

P743 – DeviceNet Reading Word #7

P744 – DeviceNet Reading Word #8

P745 – DeviceNet Reading Word #9

P746 – DeviceNet Reading Word #10

P747 – DeviceNet Reading Word #11

P748 – DeviceNet Reading Word #12

Adjustable range:	0 a 899	Factory default:	P730 = 16 P731 = 80 P732 = 81 P733 = 3 P742 = 30 P743 = 31 P744 = 32 P745 = 50 P746 = 0 P747 = 0 P748 = 0

Properties: Sys, rw

Description:

These parameters allow the user to program the reading of any other equipment parameter via network. In other words, they contain the number of another parameter.

For instance, P730 = 5. In this case the content of P005 (Line Frequency) will be sent via network. Therefore, in the network master memory position corresponding to the second reading word, the motor frequency will be read.

Relay Parameterization

Function	P728 Option											
	1	2	3	4	5	6	7	8	9	10	11	12
Status Word #1	1											
DeviceNet Reading Word #2 (content of the parameter indicated in P730)		2										
DeviceNet Reading Word #3 (content of the parameter indicated in P731)			3									
DeviceNet Reading Word #4 (content of the parameter indicated in P732)				4								
DeviceNet Reading Word #5 (content of the parameter indicated in P733)					5							
DeviceNet Reading Word #6 (content of the parameter indicated in P742)						6						
DeviceNet Reading Word #7 (content of the parameter indicated in P743)							7					
DeviceNet Reading Word #8 (content of the parameter indicated in P744)								8				
DeviceNet Reading Word #9 (content of the parameter indicated in P745)									9			
DeviceNet Reading Word #10 (content of the parameter indicated in P746)										10		
DeviceNet Reading Word #11 (content of the parameter indicated in P747)											11	
DeviceNet Reading Word #12 (content of the parameter indicated in P748)												12

P734 – Number of Words from the Master to the Slave

Adjustable range:	1 to 4	Factory default: 1

Properties: Sys, rw

Description:

It allows selecting the number of output words exchanged with the master. Each word has the following meaning:

1st Word: it represents the control word which depends on the chosen operation mode. In order to facilitate the diagnosis, the content of this word is shown at the parameter P735.
2nd Word: It is a content sent to the master, programmable via the parameter P736.
3rd Word: It is a content sent to the master, programmable via the parameter P737.
4th Word: It is a content sent to the master, programmable via the parameter P738.

> **NOTE!**
> If the parameter P734 is changed, it will only become effective after cycling the power of the relay.

P735 – Control Word #1

Adjustable range:	0000h – FFFFh	Factory default: 0000h

Properties: RO

Description:

It is the relay control word via DeviceNet interface. This parameter can only be changed via the DeviceNet interface. For the other sources (HMI, USB, Serial, etc.) it behaves like a read-only parameter. Actually, it represents the control word itself, whose data format varies according to the chosen operation mode (P202).

In order that the commands written in this parameter be executed, it is necessary that the relay be in remote mode. For the Local/Remote selection and the control of the digital outputs, it is necessary to program the parameters P220 and P277 to P280 with the "Fieldbus" option.

Transparent Mode (P202 = 0):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Value for O3 output	Value for O2 output	Value for O1 output	Remote Mode	Reset	Reserved	Reserved	Reserved

Bits (Byte 0 and 1)	Values
Bits 0 to 2	Reserved
Bit 3 Reset	**0 → 1**: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode
Bit 5 Value for O1 output	**0**: deactivates the O1 digital output **1**: activates the O1 digital output
Bit 6 Value for O2 output	**0**: deactivates the O2 digital output **1**: activates the O2 digital output
Bits 7 Value for O3 output	**0**: deactivates the O3 digital output **1**: activates the O3 digital output
Bit 8 Value for O4 output	**0**: deactivates the O4 digital output **1**: activates the O4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	**0**: deactivates the O5 digital output **1**: activates the O5 digital output
Bit 12 Value for O6 output	**0**: deactivates the O6 digital output **1**: activates the O6 digital output
Bits 13 Value for O7 output	**0**: deactivates the O7 digital output **1**: activates the O7 digital output
Bit 14 Value for O8 output	**0**: deactivates the O8 digital output **1**: activates the O8 digital output
Bit 15	Reserved

Overload Relay Mode (P202 = 1):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Value for O3 output	Reserved	Reserved	Remote Mode	Reset	Reserved	Reserved	Reserved

Bits (Byte 0 and 1)	Values
Bits 0 to 2	Reserved
Bit 3 Reset	**0 → 1**: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode
Bits 5 e 6	Reserved
Bits 7 Value for O3 output	**0**: deactivates the O3 digital output **1**: activates the O3 digital output
Bit 8 Value for O4 output	**0**: deactivates the O4 digital output **1**: activates the O4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)

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Bit 11 Value for O5 output	**0**: deactivates the O5 digital output **1**: activates the O5 digital output
Bit 12 Value for O6 output	**0**: deactivates the O6 digital output **1**: activates the O6 digital output
Bits 13 Value for O7 output	**0**: deactivates the O7 digital output **1**: activates the O7 digital output
Bit 14 Value for O8 output	**0**: deactivates the O8 digital output **1**: activates the O8 digital output
Bit 15	Reserved

Direct Start Mode (P202 = 2):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Value for O3 output	Value for O2 output	Reserved	Remote Mode	Reset	Reserved	ON	OFF

Bits (Byte 0 and 1)	Values
Bit 0 ON	**0 → 1**: stops the motor
Bit 1 OFF	**0 → 1**: starts the motor
Bit 2	Reserved
Bit 3 Reset	**0 → 1**: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode
Bit 5	Reserved
Bit 6 Value for O2 output	**0**: deactivates the O2 digital output **1**: activates the O2 digital output
Bit 7 Value for O3 output	**0**: deactivates the O3 digital output **1**: activates the O3 digital output
Bit 8 Value for O4 output	**0**: deactivates the O4 digital output **1**: activates the O4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	**0**: deactivates the O5 digital output **1**: activates the O5 digital output
Bit 12 Value for O6 output	**0**: deactivates the O6 digital output **1**: activates the O6 digital output
Bits 13 Value for O7 output	**0**: deactivates the O7 digital output **1**: activates the O7 digital output
Bit 14 Value for O8 output	**0**: deactivates the O8 digital output **1**: activates the O8 digital output
Bit 15	Reserved

Reverse Start Mode (P202 = 3):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Value for O3 output	Reserved	Reserved	Remote Mode	Reset	Reverse START	Forward START	OFF

Bits (Byte 0 and 1)	Values
Bit 0 OFF	0 → 1: turns off the motor
Bit 1 Forward START	0 → 1: turns on the motor in forward direction
Bit 2 Reverse START	0 → 1: turns on the motor in reverse direction
Bit 3 Reset	0 → 1: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	0: changes to Local Mode 1: changes to Remote Mode
Bits 5 e 6	Reserved
Bit 7 Value for O3 output	0: deactivates the O3 digital output 1: activates the O3 digital output
Bits 8 Value for O4 output	0: deactivates the O4 digital output 1: activates the O4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	0: deactivates the O5 digital output 1: activates the O5 digital output
Bit 12 Value for O6 output	0: deactivates the O6 digital output 1: activates the O6 digital output
Bits 13 Value for O7 output	0: deactivates the O7 digital output 1: activates the O7 digital output
Bit 14 Value for O8 output	0: deactivates the O8 digital output 1: activates the O8 digital output
Bit 15	Reserved

Star-Delta Mode (P202 = 4):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Reserved	Reserved	Reserved	Remote Mode	Reset	Reserved	ON	OFF

Bits (Byte 0 and 1)	Values
Bit 0 OFF	0 → 1: turns off the motor
Bit 1 ON	0 → 1: turns on the motor
Bit 2	Reserved
Bit 3 Reset	0 → 1: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	0: changes to Local Mode 1: changes to Remote Mode
Bits 5 to 7	Reserved
Bit 8 Value for O4 output	0: deactivates the O4 digital output 1: activates the O4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	0: deactivates the O5 digital output 1: activates the O5 digital output
Bit 12 Value for O6 output	0: deactivates the O6 digital output 1: activates the O6 digital output
Bits 13 Value for O7 output	0: deactivates the O7 digital output 1: activates the O7 digital output
Bit 14 Value for O8 output	0: deactivates the O8 digital output 1: activates the O8 digital output

Bit 15	Reserved

Dahlander Mode (P202 = 5):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Reserved	Reserved	Reserved	Remote Mode	Reset	Low speed START	High speed START	OFF

Bits (Byte 0 and 1)	Values
Bit 0 OFF	**0 → 1**: turns off the motor
Bit 1 High speed START	**0 → 1**: turns on the motor with high speed
Bit 2 Low speed START	**0 → 1**: turns on the motor with low speed
Bit 3 Reset	**0 → 1**: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode
Bits 5 to 7	Reserved
Bit 8 Value for O4 output	**0**: deactivates the O4 digital output **1**: activates the O4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	**0**: deactivates the O5 digital output **1**: activates the O5 digital output
Bit 12 Value for O6 output	**0**: deactivates the O6 digital output **1**: activates the O6 digital output
Bits 13 Value for O7 output	**0**: deactivates the O7 digital output **1**: activates the O7 digital output
Bit 14 Value for O8 output	**0**: deactivates the O8 digital output **1**: activates the O8 digital output
Bit 15	Reserved

Pole-Changing Mode (P202 = 6):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Reserved	Reserved	Reserved	Remote Mode	Reset	Low speed START	High speed START	OFF

Bits (Byte 0 and 1)	Values
Bit 0 OFF	**0 → 1**: turns off the motor
Bit 1 High speed START	**0 → 1**:: turns on the motor with high speed
Bit 2 Low speed START	**0 → 1**: turns on the motor with low speed
Bit 3 Reset	**0 → 1**: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode

Bits 5 to 7	Reserved
Bit 8 Value for O4 output	**0**: deactivates the DO4 digital output **1**: activates the DO4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	**0**: deactivates the O5 digital output **1**: activates the O5 digital output
Bit 12 Value for O6 output	**0**: deactivates the O6 digital output **1**: activates the O6 digital output
Bits 13 Value for O7 output	**0**: deactivates the O7 digital output **1**: activates the O7 digital output
Bit 14 Value for O8 output	**0**: deactivates the O8 digital output **1**: activates the O8 digital output
Bit 15	Reserved

PLC Mode (P202 = 7):

Control (Output)

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Value for O8 output	Value for O7 output	Value for O6 output	Value for O5 output	Auxiliary bit #2	Auxiliary bit #1	Value for O4 output	Value for O3 output	Value for O2 output	Value for O1 output	Remote Mode	Reset	Reserved	Reserved	Reserved

Bits (Byte 0 and 1)	Values
Bits 0 to 2	Reserved
Bit 3 Reset	**0 → 1**: when faulted (trip), it executes the relay reset
Bit 4 Remote Mode	**0**: changes to Local Mode **1**: changes to Remote Mode
Bits 5 Value for 01 output	**0**: deactivates the DO1 digital output **1**: activates the DO1 digital output
Bits 6 Value for O2 output	**0**: deactivates the DO2 digital output **1**: activates the DO2 digital output
Bit 7 Value for O3 output	**0**: deactivates the DO3 digital output **1**: activates the DO3 digital output
Bit 8 Value for 04 output	**0**: deactivates the DO4 digital output **1**: activates the DO4 digital output
Bits 9 a 10	Auxiliary bit (user defined function)
Bit 11 Value for O5 output	**0**: deactivates the O5 digital output **1**: activates the O5 digital output
Bit 12 Value for O6 output	**0**: deactivates the O6 digital output **1**: activates the O6 digital output
Bits 13 Value for O7 output	**0**: deactivates the O7 digital output **1**: activates the O7 digital output
Bit 14 Value for O8 output	**0**: deactivates the O8 digital output **1**: activates the O8 digital output
Bit 15	Reserved

NOTE!
Most of the bit commands in the words above have a behavior similar to push-buttons, i.e., only the 0 to 1 transition matters. Thus, the network engineer must pay attention to write 0 (zero) again in those bits after sending a valid transition command.

Relay Parameterization

P736 – DeviceNet Writing Word #2

P737 – DeviceNet Writing Word #3

P738 – DeviceNet Writing Word #4

Adjustable range:	0 to 899	Factory default: 0

Properties:	Sys, rw

Description:

These parameters allow the user to program the writing of any other equipment parameter via network. In other words, it contains the number of another parameter.

For instance, P736 = 163. In this case the content to be written in P163 (disabling of user program) will be sent via network. Therefore, the network master memory position corresponding to the second writing word, must contain the value for P163.

Function	P734 Option			
Control Word #1	1			
DeviceNet Writing Word #2 (content of the parameter programmed in P736)		2		
DeviceNet Writing Word #3 (content of the parameter programmed in P737)			3	
DeviceNet Writing Word #4 (content of the parameter programmed in P738)				4

4 ERRORS RELATED TO THE DEVICENET COMMUNICATION

E0061 – *Bus Off*

Description:
A *bus off* error has been detected in the CAN interface.

Trip:
If the number of reception or transmission errors detected by the CAN interface is too high, the CAN controller can be taken to the *bus off* state, where it interrupts the communication and disables the CAN interface.

If a *bus off* error occurs, the CAN communication will be disabled, the E0061 alarm will appear at the relay HMI, and the action programmed in P313 will be executed. In order that the communication be reestablished, it is necessary to cycle the power of the relay or remove and apply again the CAN interface supply, so that the communication is reinitiated.

Possible Causes/Correction:
- ☑ Inspect the CAN circuit transmission cables for short-circuit.
- ☑ Make sure the cables are not changed or inverted.
- ☑ Verify if termination resistors with the correct values were installed only at the extremes of the main bus.
- ☑ Verify if the CAN network installation has been carried out in an adequate manner.

E0063 – CAN interface Without Power Supply

Description:
It indicates that the CAN interface does not have supply voltage between the pins BK and RD of XC2.

Trip:
In order that it be possible to send and receive telegrams through the CAN interface, it is necessary to provide an external power supply to the interface circuit.

If the absence of supply at the CAN interface is detected, the communication is disabled, E0063 will be showed on the relay HMI and the action programmed at P313 will be executed. If the circuit supply is reestablished, the alarm indication will be removed from the HMI and the CAN communication will be reinitiated.

Possible Causes/Correction:
- ☑ Measure the voltage between the pins BK and RD of the CAN interface connector, making sure it is approximately 24V.
- ☑ Make sure the power supply cables are not changed or inverted.
- ☑ Inspect the cable and the CAN interface connector for contact problems.

E0064 – Idle Master

Description:
It is the alarm indicating that the DeviceNet master is in *idle* mode.

Trip:
It trips when the relay detects that the network master entered the *idle* mode. In this mode, only the variables read from the slave keep being updated in the master memory. None of the commands sent to the slaves is processed.

In this case E0064 will be showed on the relay HMI. It is necessary to put the master again in run mode (normal operation state of the equipment) so that communication is reestablished and the warning message be removed from the HMI.

Possible Causes/Correction:
- ☑ Adjust the switch that commands the master operation mode for execution (Run), or set the correspondent bit of the master software configuration word. In case of doubts, refer to the used master documentation.

E0067 – DeviceNet Connection Timeout

Description:
It is the alarm indicating that one or more DeviceNet I/O connections have expired.

Trip:
It occurs when for some reason the master is not able to access information from the slave.

E0067 will be showed on the relay HMI in this case.

Possible Causes/Correction:
☑ Verify if the master is present in the network and if it is in the *Run* mode.

E0067 – DeviceNet Connection Timeout