ReeR

FIELDBUS MODULES

MOSAIC

Micron

Installation and use

ReeR

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MOSAIC FIELDBUS MODULES

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INTRODUCTION

The following tables describe the main characteristics of the BUS modules of the MOSAIC series according to the firmware version.

Firmware version <3.0.0			
Code	**Installed stacks**	**Data source**	**Base Ethernet**
MBP	PROFIBUS DP-V1	MOSAIC Master	NO
MBD	DeviceNet	MOSAIC Master	NO
MBC	CANopen	MOSAIC Master	NO
MBCCL	CC-Link	MOSAIC Master	NO
MBMR	Modbus RTU	MOSAIC Master	NO
MBEPL	POWERLINK	MOSAIC Master	YES
MBEC	EtherCAT	MOSAIC Master	YES
MBEI	EtherNet/IP	MOSAIC Master	YES
MBEP	PROFINET	MOSAIC Master	YES
MBEM	Modbus TCP	MOSAIC Master	YES
MBU	None	MOSAIC Master	NO
MI-BP	PROFIBUS DP-V1	Micron barrier	NO
MI-BD	DeviceNet	Micron barrier	NO
MI-BC	CANopen	Micron barrier	NO
MI-BCCL	CC-Link	Micron barrier	NO
MI-BMR	Modbus RTU	Micron barrier	NO
MI-BEC	EtherCAT	Micron barrier	YES
MI-BEI	EtherNet/IP	Micron barrier	YES
MI-BEP	PROFINET	Micron barrier	YES
MI-BEM	Modbus TCP	Micron barrier	YES
MI-BU	None	Micron barrier	NO

Firmware version ≥ 3.0.0			
Code	**Installed stacks**	**Data source**	**Base Ethernet**
MBECOM	EtherCAT, EtherNet/IP, PROFINET, Modbus TCP	MOSAIC Master	YES
MBEC	EtherCAT	MOSAIC Master	YES
MBEI	EtherNet/IP	MOSAIC Master	YES
MBEP	PROFINET	MOSAIC Master	YES
MBEM	Modbus TCP	MOSAIC Master	YES
MBU	None	MOSAIC Master	NO
MI-BECOM	EtherCAT, EtherNet/IP, PROFINET, Modbus TCP	Micron barrier	YES
MI-BEC	EtherCAT	Micron barrier	YES
MI-BEI	EtherNet/IP	Micron barrier	YES
MI-BEP	PROFINET	Micron barrier	YES
MI-BEM	Modbus TCP	Micron barrier	YES
MI-BU	None	Micron barrier	NO

DESCRIPTION

The MBx communication modules give access to various information relating to the Mosaic system, while the MI-Bx communication modules give access to information relating to the Micron barriers. Both modules allow sending of commands from the PLC.

Each device connected to the Mosaic inputs is characterized by an ON/OFF status and possible diagnostics. The processing of the inputs based on the program loaded on Mosaic generates the ON/OFF status of the safety outputs; diagnostics are also available for the latter.

Instead, the data coming from the Micron barriers concern the status of the beams (free or busy) or the measurements.

ELECTRICAL CONNECTIONS

- Install modules in an enclosure with a protection class of at least IP54.
- The supply voltage to the modules must be 24Vdc ±20% (PELV, compliant with EN 60204-1 (Chapter 6.4)).
- Do not use MOSAIC to supply external devices.
- The same ground connection (0VDC) must be used for all system components.

POSSIBLE CONNECTIONS OF MBX / MI-BX MODULES

In this case, the MBx and MI-Bx modules are connected to the data source (Master M1/M1S or Micron barrier).

The connection of the PC via USB cable (USB "C" interface) is used to configure the module and, if desired, to monitor the data arriving from the source.

The connection with the PLC is used for data exchange (both cyclic and acyclic) via the network interface.
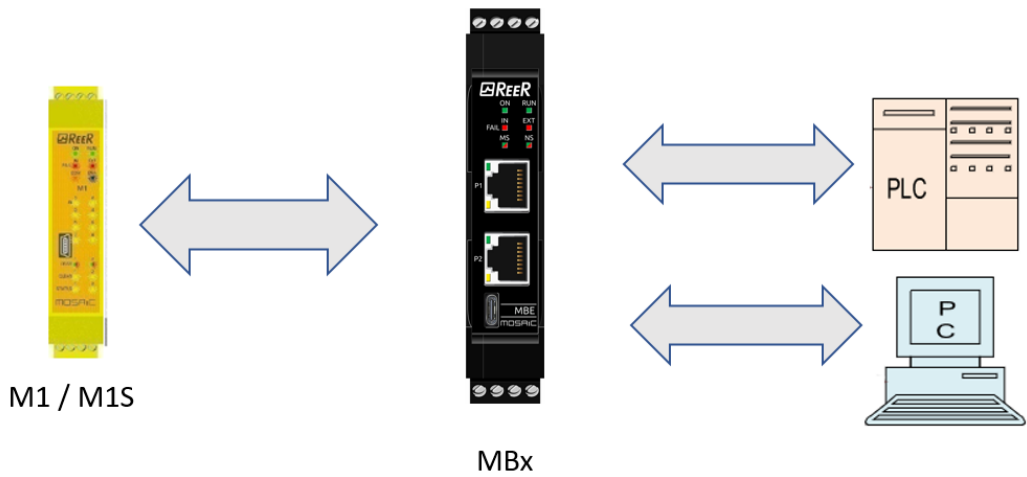
M1 / M1S   MBx

Micron   MI-Bx

POSSIBLE CONNECTIONS OF MBU / MI-BU MODULES

In this case, the MBU and MI-BU modules are connected to the data source (M1/M1S Master or Micron barrier).

The connection of the PC via USB cable (USB "C" interface) is used to configure the module and, if desired, to monitor the data arriving from the source.

The connection with the PLC does not exist because this type of module is not equipped with a network interface.

M1 / M1S   MBU   PC

Micron   MI-BU   PC
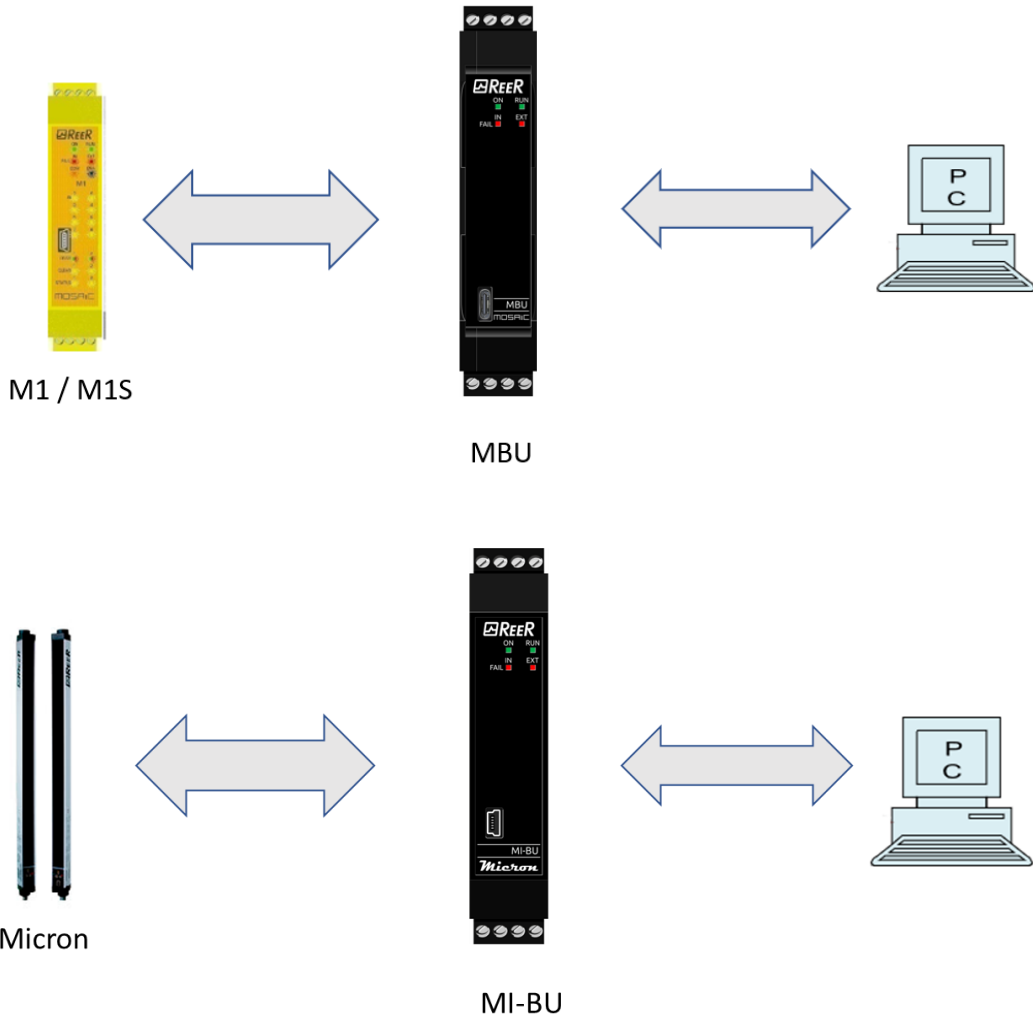
MODULES FW VERSION < 3.0.0

Each module is equipped with four connectors (Figure 1):

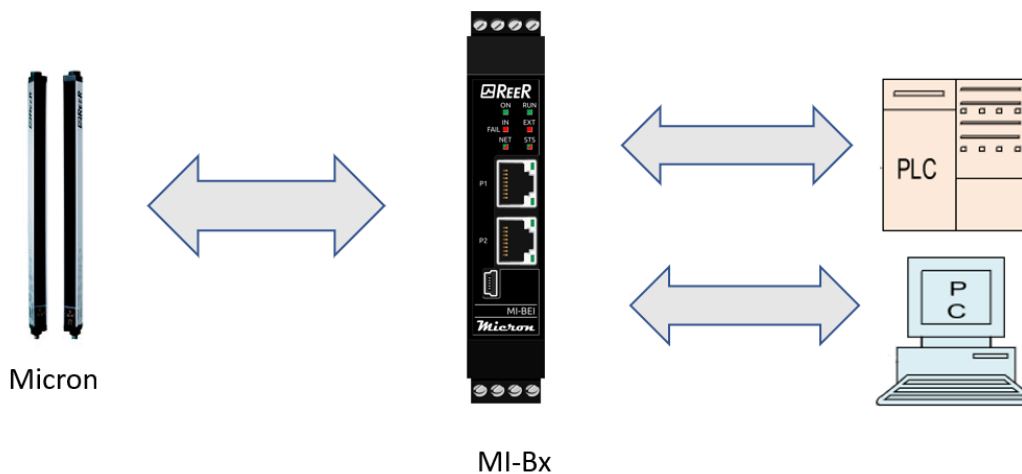|	
MSC five-way connector	to the MOSAIC system
Mini-USB connector	to a PC
BUS/LAN connectors	to the fieldbus or the Ethernet network (not present on MBU)
Front terminal strip	supply

TERMINAL STRIP CONNECTIONS (SIDE A - TOP)		TERMINAL STRIP CONNECTIONS (SIDE B - BOTTOM)	
TERMINAL	SIGNAL	TERMINAL	SIGNAL
1	24VDC + 20%	5	-
2	-	6	RS-485 serial line - (A)
3	-	7	GND
4	GND	8	Serial line RS-485 + (B)
		➔ The lower connector with RS-485 interface is used only for data exchange with the HM1	

Table 1
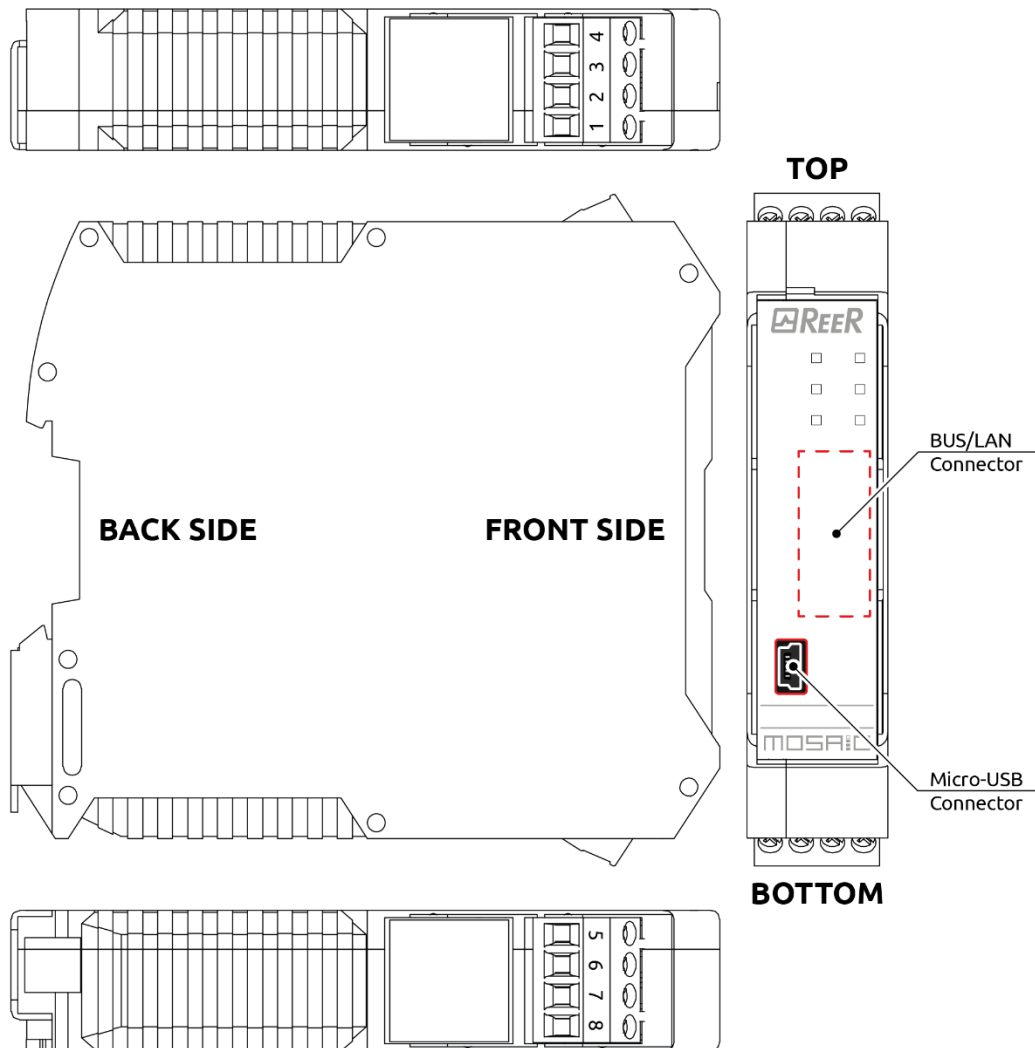
Figure 1

SIGNALS AND PINOUT

Initial / Dynamic view

MEANING	LED					
	ON	**RUN**	**IN FAIL**	**EXT FAIL**	**LED1**	**LED2**
	GREEN	GREEN	RED	RED	RED/GREEN	RED/GREEN
Startup - Initial test	ON	ON	ON	ON	ON	ON
Waiting for configuration from M1/M1S	ON	OFF	OFF	OFF	OFF	OFF
Received configuration from M1/M1S	ON	ON	OFF	OFF	see the modules tables	

Table 2 - Initial/dynamic view

Diagnostics signals

FAULT DIAGNOSIS						
MEANING	LED					
	ON	**RUN**	**IN FAIL**	**EXT FAIL**	**LED1**	**LED2**
	GREEN	GREEN	RED	RED	RED/GREEN	RED/GREEN
Internal fault microcontroller	ON	OFF	2 flashes*	OFF	see the modules tables	
Internal board fault	ON	OFF	3 flashes*	OFF		
Configuration Error	ON	OFF	5 flashes*	OFF		
BUS communication Error	ON	OFF	5 flashes*	OFF		
BUS communication interruption	ON	OFF	ON	OFF		
Detected an identical module	ON	OFF	5 flashes*	5 flashes*		

Table 3 - Fault diagnosis

* The LED frequency of flashing is: ON for 300ms and OFF for 400ms, with an interval between two sequences of 1s.

MODULE MBC / MI-BC

Pin	Signal
1	**-**
2	**CAN_L**
3	**CAN_GND**
4	**-**
5	**CAN_SHIELD**
6	**-**
7	**CAN_H**
8	**-**
9	**-**
Housing	**CAN_SHIELD**

DB9 – male
(front view)

LED OPR		
STATUS	**INDICATION**	**DESCRIPTION**
GREEN	OPERATIONAL	OPERATIONAL status
GREEN blinking slow	PRE-OPERATIONAL	PRE-OPERATIONAL status
GREEN 1 flash	STOPPED	STOPPED status
GREEN blinking fast	Autobaud	Baud rate detection
RED	EXCEPTION	EXCEPTION status

LED ERR		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	-	Normal operation
RED 1 flash	Warning level	A bus error counter has reached the warning level
RED blinking fast	LSS	LSS service operative
RED 2 flashes	Event Control	Detected ***Node Guarding*** (NMT master or slave) or ***Heartbeat*** (Consumer)
RED	Lack of BUS	BUS not working

MODULE MBD / MI-BD
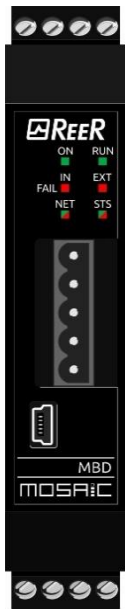
Pin	Signal	Description
1	**V-**	Negative BUS power supply
2	**CAN_L**	CAN low bus line
3	**SHIELD**	Cable shield
4	**CAN_H**	CAN high bus line
5	**V+**	Positive BUS power supply

(front view)

LED NET		
STATUS	**INDICATION**	**DESCRIPTION**
GREEN	On-line connected	1 or more connections established
GREEN blinking (1Hz)	On-line non connected	No connection established
RED	Critical connection error	MBD unable to communicate
RED blinking (1Hz)	Time-out of 1 or more connection	One or more I/O device in time-out
GREEN/RED alternate	TEST	MBD in Test

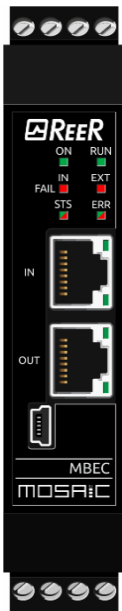| LED STS		
STATUS	**INDICATION**	**DESCRIPTION**
GREEN	-	Normal operation
GREEN blinking (1Hz)	Pending	Configuration incomplete, MBD waiting for activation
RED	Fatal error	One or more unrecoverable errors detected
RED blinking (1Hz)	Error	One or more recoverable errors detected
GREEN/RED alternate	TEST	MBD in Test

MODULE MBP / MI-BP
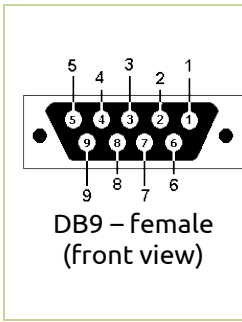
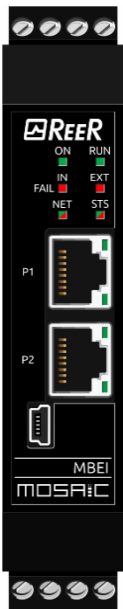| Pin	Signal	Description
1	-	-
2	-	-
3	**B-line**	Positive RxD/TxD, RS485 level
4	**RTS**	Request to send
5	**GND Bus**	0VDC (isolated)
6	**5V**	+5VDC (isolated/short circuit protected)
7	-	-
8	**A-line**	Negative RxD/TxD, RS485 level
9	-	-
Housing	**Cable shield**	Internally connected to the Anybus protective earth via cable shield filters according to the PROFIBUS standard

DB9 – female
(front view)

LED MODE		
STATUS	**INDICATION**	**DESCRIPTION**
GREEN	On-line	data exchange
GREEN blinking	On-line	CLEAR
RED blinking (1 flash)	Parameterization error	rif. IEC 61158-6
RED blinking (2 flashes)	PROFIBUS configuration error	configuration data MASTER or MBP wrong

LED STS		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	MBP not initialized	Status **SETUP** o **NW_INIT**
GREEN	Initialized	End of initialization **NW_INIT**
GREEN blinking	Initialized with diagnostic active	**EXTENDED DIAGNOSTIC** bit set
RED	Exception error	**EXCEPTION** status

MODULE MBEC / MI-BEC

LED STS		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	INIT	INIT or no power
GREEN	OPERATIONAL	OPERATIONAL state
GREEN blinking	PRE-OPERATIONAL	PRE-OPERATIONAL state
GREEN blinking (1 flash)	SAFE-OPERATIONAL	SAFE-OPERATIONAL state
Flickering	BOOT	Module in BOOT state
Red	(Fatal Event)	System locked

| LED ERR		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	No error	No error or no power
RED blinking	Configuration not valid	Status change requested by master not possible
RED blinking (1 flash)	Unsolicited state change	Slave device application has changed the module state
RED blinking (2 flashes)	Watchdog timeout	Synch manager watchdog timeout
Red	Controller failure	Anybus module in EXCEPTION state
Flickering	Booting error	E.g. due to firmware download failure

MODULE MBEI / MI-BEI

LED NET	
STATE	**INDICATION / DESCRIPTION**
OFF	No power or no IP address
GREEN	On-line, connected
GREEN blinking	On-line, not connected
RED	Duplicate IP address
RED blinking	Connection timeout

LED STS		
STATE	**INDICATION**	**DESCRIPTION**
OFF	No power	-
GREEN	RUN state	-
GREEN blinking	Not configured	-
RED	Fatal error	One or more non-recoverable errors detected
RED blinking	Error	One or more recoverable errors detected

1. **MBEI module comes with 2x RJ45 ports. This is a dual port switch**
2. **MBEI module supports both linear and ring topology (DLR, Device Level Ring)**

MODULE MBEP / MI-BEP

LED NET		
STATE	**INDICATION**	**DESCRIPTION**
OFF	Offline	• No power • Connection with IO controller not present
GREEN	Online (RUN)	• Established connection with IO controller • IO controller in RUN state
GREEN blinking (1 flash)	Online (STOP)	• Established connection with IO Controller • IO Controller in STOP state or IO data bad • IRT synchronization not finished
GREEN blinking	Blink	Used to identify the network node
RED	Fatal event	Major internal error (combined with a red module STS led)
RED blinking (1 flash)	Station Name error	Station Name not set
RED blinking (2 flashes)	IP address error	IP address not set
RED blinking (3 flashes)	Configuration error	Expected identification differs from real identification

LED STS		
STATE	**INDICATION**	**DESCRIPTION**
OFF	Not initialized	No power or Module in SETUP or NW_INIT state
GREEN	Normal operation	Module has shifted from the NW_INIT state
GREEN blinking (1 flash)	Diagnostic event(s)	Diagnostic event(s) present
RED	Exception error	Device in state EXCEPTION
	Fatal event	Major internal error (combined with a red NET led module)
Alternating RED/GREEN	Firmware update	Do NOT power off the module. It could cause a permanent damage

MODULE MBEM / MI-BEM
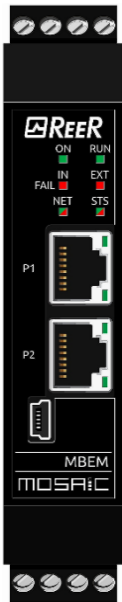
LED NET	
STATE	**INDICATION / DESCRIPTION**
OFF	Module in EXCEPTION state or no IP address
GREEN	On-line, at least one message received
GREEN blinking	On-line, waiting for first message
RED	IP address conflict, FATAL ERROR
RED blinking	Connection Timeout. No message received

| LED STS	
STATE	**INDICATION / DESCRIPTION**
OFF	No power
VERDE	Normal operation
ROSSO	Major fault; module in state EXCEPTION (or fatal event)
RED blinking	Minor fault detected
Alternating RED/GREEN	Firmware update from file system in progress

MODULE MBCCL / MI-BCCL
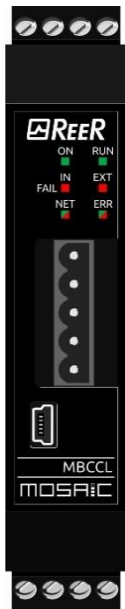
Pin	Signal	Description
1	**DA**	Positive RS485 RxD/TxD
2	**DB**	Negative RS485 RxD/TxD
3	**DG**	Signal Ground
4	**SLD**	Cable shield
5	**FG**	Protective Earth

(front view)

LED NET	
STATUS	**DESCRIPTION**
OFF	No network participation, timeout status (no power)
GREEN	Participating, normal operation
RED	Major fault (FATAL error)

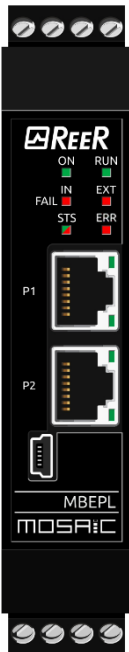| LED ERR		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	No error (no power)	Normal operation
RED	Major fault	Exception or FATAL event
RED flickering	(Temporary flickering) CRC	CRC Error
RED flashing	(Continuous flashing) PARAMETERS	Station Number or Baud Rate has changed since startup

MODULE MBMR / MI-BMR

DB9 – female
(front view)
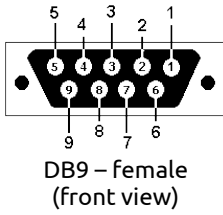
Pin	Direction	Signal	Description
Housing	-	PE	Protective Earth
1	-	GND	Bus polarization 0VDC (isolated)
2	OUT	5V	Bus polarization +5VDC (isolated)
3	IN	PMC	Connect to pin 2 for RS-232 / Leave unconnected for RS-485
4	-	-	-
5	Bidirectional	B-line	RS-485 B-line
6	-	-	-
7	IN	Rx	RS-232 Data Receive
8	OUT	Tx	RS-232 Data Transmit
9	Bidirectional	A-line	RS-485 A-line

LED NET		
STATE	**INDICATION**	**DESCRIPTION**
OFF	No power or no data exchange	**-**
YELLOW	Frame Reception or Transmission	Data exchange
RED	Fatal Error	One or more non-recoverable errors detected

LED STS		
STATE	**INDICATION**	**DESCRIPTION**
OFF	Initializing or no power	-
GREEN	Module initialized	Module initialized – no error
RED	Fatal Error	One or more non-recoverable errors detected
RED blinking (1 flash)	Communication fault or configuration error	1. Invalid setting in Network Configuration Object 2. Setting in Network Configuration Object has been changed during operation
RED blinking (2 flashes)	Application diagnostic available	

MODULE MBEPL

LED STS		
STATE	**INDICATION**	**DESCRIPTION**
OFF	Off	Module is off, initializing, or not active.
GREEN fast flashing (on 50ms - off 50ms)	NMT_CS_BASIC_ETHERNET	Basic Ethernet state: no POWERLINK traffic has been detected.
GREEN single flash	NMT_CS_PRE_OPERATIONAL_1	Only asynchronous data.
GREEN double flash	NMT_CS_PRE_OPERATIONAL_2	Asynchronous and synchronous data. No PDO data. Any process data sent is declared not valid and received process data must be ignored in this state.
GREEN triple flash	NMT_CS_READY_TO_OPERATE	Ready to operate. Asynchronous and synchronous data. No PDO data. Any process data sent is declared not valid and received process data must be ignored in this state.
GREEN	NMT_CS_OPERATIONAL	Fully operational. Asynchronous and synchronous data. PDO data is sent and received.
GREEN slow flashing (ON 200ms - OFF 200ms)	NMT_CS_STOPPED	Module stopped (for controlled shutdown, for example). Asynchronous and synchronous data. No PDO data. Any process data sent is declared not valid and received process data must be ignored in this state.
RED	Error	If the ERROR LED also is red, a fatal event was encountered.

LED ERR		
STATE	**INDICATION**	**DESCRIPTION**
OFF	No error	No error
RED	Error	If the STATUS LED is not red, a non-fatal error has been detected. If the STATUS LED is red, a fatal event was encountered

MODULE MBU / MI-BU

LED CONNECT		
STATE	**INDICATION**	**DESCRIPTION**
GREEN	USB connected	Module connected to Pc via USB
OFF	USB not connected	Module not connected

MODULES FW VERSION ≥ 3.0.0

Each module is equipped with four connectors (Figure 2):

MSC 5-way connector	to the MOSAIC system
USB "C" connector	to a PC
BUS/LAN connectors	to the fieldbus or the Ethernet network (not present on MBU)
Front terminal strip	power supply

TERMINAL STRIP CONNECTIONS (SIDE A - TOP)		TERMINAL STRIP CONNECTIONS (SIDE B - BOTTOM)	
TERMINAL	SIGNAL	TERMINAL	SIGNAL
1	24VDC ± 20%	13	-
2	-	14	RS-485 serial line - (A)
3	-	15	GND
4	GND	16	RS-485 serial line + (B)

➔ *The lower connector with RS-485 interface is used only for data exchange with the HM1*

Table 4
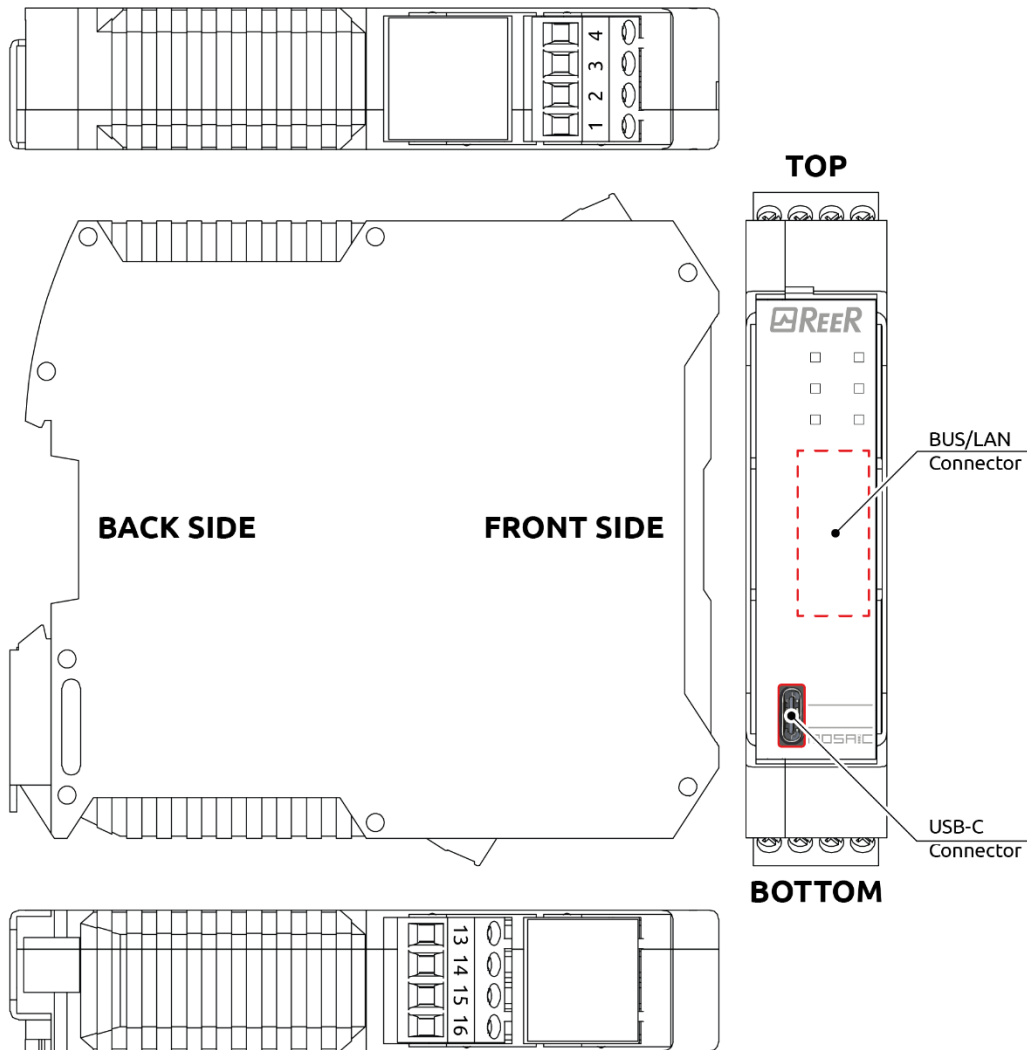
Figure 2

When the module is switched on, the presence or absence of the data source is checked (be it a M1/M1S Master module or a Micron barrier). If no data source is detected within ten seconds, the module will start anyway the Ethernet communication and will start with a default process map having the following dimensions:

- MBx modules: 4 bytes of fieldbus inputs / 33 bytes of I/O
- MI-Bx modules: 0 byte of fieldbus inputs / 1 byte of I/O

If the module is in "backward compatibility" mode, the default process map will have the following dimensions:

- MBx modules: 0 byte of fieldbus inputs / 1 byte of I/O
- MI-Bx modules: 0 byte of fieldbus inputs / 1 byte of I/O

SIGNALS AND PINOUTS

Initial/Dynamic Phase Signalling

MEANING	LEDs					
	ON	RUN	IN FAIL	EXT FAIL	LED1	LED2
	GREEN	GREEN	RED	RED	RED/GREEN	RED/GREEN
Power-on - Initial TEST	ON	ON	ON	ON	ON	ON
Awaiting configuration from M1/M1S	ON	OFF	OFF	OFF	OFF	OFF
Configuration received from M1/M1S	ON	ON	OFF	OFF	See single modules tables	
FWUPDATE_NNNN.ZIP file update	ON	Blinking quickly	OFF	OFF	-	

Table 5 - Opening/dynamic display

Diagnostics Signalling

TROUBLESHOOTING						
MEANING	LED					
	ON	RUN	IN FAIL	EXT FAIL	LED1	LED2
	GREEN	GREEN	RED	RED	RED/GREEN	RED/GREEN
Microcontroller internal fault	ON	OFF	Two blinks*	OFF	See single modules tables	
Card internal fault	ON	OFF	Three blinks*	OFF		
Configuration error	ON	OFF	Five blinks*	OFF		
BUS communication fault	ON	OFF	Five blinks*	OFF		
BUS interruption fault	ON	OFF	ON	OFF		
Identical module detected	ON	OFF	Five blinks*	Five blinks		

Table 6

* The LED blink timing is 300ms ON, 400ms OFF, with an interval between two sequences of 1s.

MBEC / MI-BEC MODULE
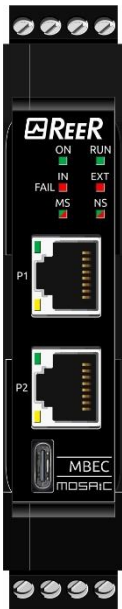
MS LED ("RUN STATUS")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	INIT	INIT state or no supply
GREEN Blinking (2.5Hz)	PRE-OPERATIONAL	PRE-OPERATIONAL status
GREEN (1 blink)	SAFE-OPERATIONAL	SAFE-OPERATIONAL status
GREEN	OPERATIONAL	OPERATIONAL status

NS LED ("ERROR STATUS")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	NO ERROR	Working EtherCAT communication
RED Blinking (2.5Hz)	INVALID CONFIGURATION	Configuration error
RED One blink	LOCAL ERROR	The slave device application changed the EtherCAT status independently.
RED Two blinks	APPLICATION WATCHDOG TIMEOUT	An application watchdog timeout occurred

MBEI / MI-BEI MODULE

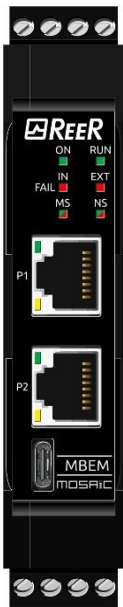| MS LED ("MODULE STATUS")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	NO POWER	The device is off
GREEN **On steady**	DEVICE OPERATIONAL	The device works perfectly
GREEN **Blinking (1Hz)**	STANDBY	The device was non configured
GREEN/RED/GREEN **Blinking green/red/green**	SELF TEST	The device is performing the power-on test. The test sequence of the module status indicator occurs before the test sequence of the network status indicator, in the following sequence: • Network status LED off. • The module status LED turns green for approximately 250ms, turns red for approximately 250ms, and turns green again (and remains in this state until the power-on test is complete). • The network status LED turns green for approx. 250ms, turns red for approximately 250ms and then turns off (and remains in this state until the power-on test is complete)
RED **Blinking (1Hz)**	MAJOR RECOVERABLE FAULT	The device has encountered a major recoverable error. For example, a bad or inconsistent configuration can be considered a major recoverable fault.
RED **On steady**	MAJOR RECOVERABLE FAULT	The device has encountered a major irrecoverable error.
NS LED ("NODE STATUS")		
STATUS	**INDICATION**	**DESCRIPTION**
GREEN **On steady**	CONNECTED	An IP address is configured, at least one CIP connection (any "transport class") is established, and an "exclusive owner" connection is not timed out.
GREEN **Blinking (1Hz)**	NO CONNECTIONS	An IP address is configured, but no CIP connection is established, and an "exclusive owner" connection is not timed out.
GREEN/RED/OFF **Blinking green/red/off**	SELF TEST	The device is performing the power-on test.
RED **Blinking (1Hz)**	CONNECTION TIMEOUT	An IP address is configured and an "exclusive owner" connection whose target is this device is timed out. The network status indicator only returns to steady green when all timed-out "exclusive owner" connections have been re-established.
RED **On steady**	DUPLICATE IP	The device detected that the IP address is already in use.
OFF	NO POWER	The device has no IP address (or is turned off)

|	
1.	**The MBEI module is equipped with two RJ45 ports. It is a dual port switch.**
2.	**The MBEI module supports both linear and device level ring (DLR) topologies.**

MBEP / MI-BEP MODULE
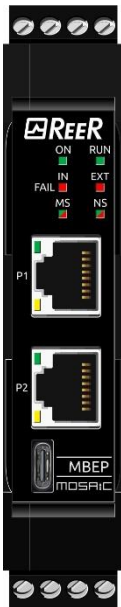
MS LED ("SYSTEM FAILURE")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	NO ERROR	No error
RED **Blinking (1Hz, 3s)**	-	DCP signal service is started via the bus
RED **On steady**	WATCHDOG TIMEOUT	Channel, generic or extended diagnostics present; system error

NS LED ("BUS FAILURE")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	NO ERROR	No error
RED	NO DATA EXCHANGE	No data exchange
RED	NO CONFIGURATION	No configuration or physical connection at low speed; no physical connection

MBEM / MI-BEM MODULE

MS LED ("MODULE STATUS")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	NOT READY	OMB task is not ready.
GREEN **On steady**	CONNECTED	OMB task has established a communication. At least a TCP connection is established.
GREEN **Blinking (1Hz)**	READY, NOT CONFIGURED YET	OMB task is ready, but not configured yet.
GREEN **Blinking (5Hz)**	WAITING FOR COMMUNICATION	OMB task is not configured.

NS LED ("ERROR STATUS")		
STATUS	**INDICATION**	**DESCRIPTION**
OFF	NO ERROR	No communication error
RED **Blinking** **(2Hz, 25% on)**	SYSTEM ERROR	System error
RED **On steady**	COMMUNICATION ERROR	Communication error

MBECOM / MI-BECOM MODULE
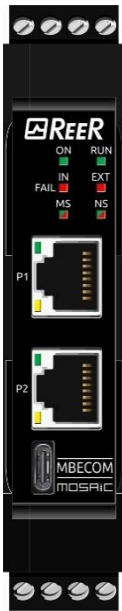
The MBECOM/MI-BECOM module is a multi-stack module. Therefore, the user, through of the BUS software
configurator can choose which stack to install the module on. The available stacks are:

- EtherNet/IP -> *MBEI / MI-BEI Module*
- Modbus TCP -> *MBEM / MI-BEM Module*
- PROFINET   -> *MBEP / MI-BEP Module*
- EtherCAT   -> *MBEC / MI-BEC Module*

Refer to the previous sections for the meaning of the blinking LEDs.

MBU / MI-BU MODULE

LED CONNECT		
STATUS	**INDICATION**	**DESCRIPTION**
GREEN	USB connected	Module connected to PC via USB
Off	USB not connected	Module not connected

PROCESS MAP

MBx MODULES: CYCLIC DATA

System and I/O status is available on the cyclic process map.

Cyclic data is listed in the table below

Data direction: from the module to the PLC	
Data	**Notes**
System status (status byte)	Indicates the status of the Master, the presence of diagnostics and errors.
Inputs	status of inputs
Restart inputs	status of the restart inputs (available with firmware version ≥ 3.0.0)
Fieldbus feedback inputs status	-
Probe output status	state of the probes
OSSD output status	status of the safety outputs
Analogue data (float format)	Value of the analogue measurements (provided that at least one MAx module is present and configured)
Data direction: from the PLC to the module	
Fieldbus input status	

The presence or absence of analogue data and restart inputs can be selected by the user via the BUS Configurator. Therefore, you can have four possible fixed maps.

Data direction	Data type	Map 1 (bytes)	Map 2 (bytes)	Map 3 (bytes)	Map 4 (bytes)
From PLC to module	Fieldbus input status	4	4	4	4
Total from PLC to module		4	4	4	4
From module to PLC	System status (status byte)	2	2	2	2
From module to PLC	Input status	16	16	16	16
From module to PLC	Restart input status	0	0	3	3
From module to PLC	Fieldbus feedback inputs status	4	4	4	4
From module to PLC	Probe status (Probe)	4	4	4	4
From module to PLC	Output status (OSSD)	4	4	4	4
From module to PLC	Analogue data	0	64	0	64
Module to PLC total		30	94	33	97

MBx MODULES: ACYCLIC DATA

Acyclic data is listed in the table below:

Data	Notes
System I/O	System status + input/output status
I/O diagnostics	
System errors (if a fault is present)	Available with firmware version ≥ 2.0.0 Available only with M1/M1S in version ≥ 5.0
CRC program loaded on M1/M1S	Available only with M1/M1S in version ≥ 5.0
Analogue measurement only with floating-point format	Available with firmware version ≥ 2.0.0 Available only with M1/M1S in version ≥ 5.0
Fieldbus input	
RFID sensor data	Available with firmware version ≥ 3.0.0 Available only with M1/M1S in version ≥ 8.0

MBx MODULES: GENERAL INFORMATION

Fieldbus inputs allow the PLC to cyclically send up to 32 ON/OFF statuses and are used as non-safe inputs in the Mosaic program.

The diagnostic and error acyclic sections report significant data if the related BIT is present in the status byte.

The section dedicated to the **input status** has a size of up to 16 bytes (depending on the firmware versions) and informs about the status of max 128 inputs. The priority order of modules is the following:

- **M1/M1S, MI8O2, MI16, MI8, MI12T8, MV2T/MV2H/MV2S, MV1T/MV1H/MV1S, MV0, MA4, MI8O4, MA2.**

The section dedicated to the **safety output status** has a size of up to 4 bytes (depending on the firmware versions) and informs about the status of max 32 outputs. The priority order of modules is the following:

- **M1/M1S, MI8O2, MO2, MO4, MOR4, MOR4S8, MO4LHCS8, MI8O4, MO4L.**

In the status byte, the system status BITs are described in the following table:

	Status bytes
BIT	**BIT value meaning**
7	-
6	-
5	-
4	-
3	-
2	0: no errors 1: error
1	0: no diagnostics 1: diagnostics
0	0: Master not available 1: Master available

If two or more modules of the same type are installed, the one with the lowest node number is displayed first.

Each module equipped with digital inputs occupies several BITs corresponding to the number of physical inputs; M1/M1S, MI8, MI8O2, MI8O4 modules will therefore use 1 byte, MI12T8 and MI16 modules will use 2 bytes. MV0, MV1 and MV2 modules will use 1 byte each. MA4 and MA2 modules will use 1 byte each.

In fieldbuses where the order of the data is important (e.g., PROFIBUS, PROFINET) the fieldbus input bytes must be mapped before the output bytes.

If a fieldbus module is present in the Mosaic system, MSDesigner will include in the report a table showing the I/O index of all the inputs, fieldbus inputs, probes, and safety outputs of the wiring diagram.

For a description of the process data mapping of your fieldbus, refer to chapter "*PROCESS MAPS*".

MBx MODULES: TROUBLESHOOTING

Each safety input and output can generate a diagnostics code.

When the I/O is connected correctly, the diagnostics code is "DIAGNOSTICS_OK".

When diagnostics are generated on an input or output, the system exposes 2 bytes:

- the index of the input or output which generated the diagnostics ("I/O index").
- the relevant diagnostics code ("Diagnostics code").

"I/O INDEX" FIELD

This field indicates the number used to identify the I/Os with a diagnostics code other than "DIAGNOSTICS_OK".
The I/O index range depends on the system version used. Please refer to the following tables for the values of these data.

SYSTEM VERSION IN USE (BUS module firmware version < 2.0.0)	
TYPE OF SIGNAL	I/O INDEX
Input	1-128
Output	192-255

Table 7

SYSTEM VERSION IN USE (BUS module firmware version ≥ 2.0.0)	
TYPE OF SIGNAL	I/O INDEX
Input	1-128
Output	1-32

Table 8

The I/O index corresponds to the number of the I/O block of the MSD program.
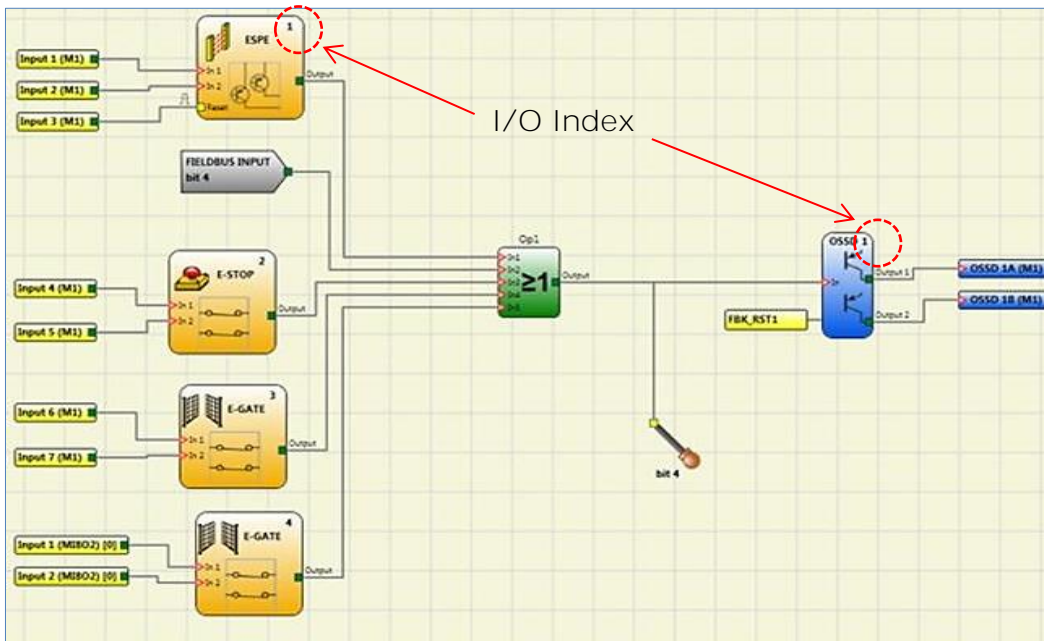
Figure 3- I/O index

"DIAGNOSTICS CODE" FIELD

To examine the diagnostics in question, read the document *"8547781 - ERRORS CODE / DIAGNOSTICS"* which can be downloaded from the website "www.reersafety.com"

MI-Bx MODULES: CYCLIC DATA

The beam status or Micron barrier measurements are available on the cyclic process map.

Cyclic data is listed in the table below:

Data direction: from the module to the PLC	
Data	**Notes**
Beams status/measurements	
Data direction: from the PLC to the module	
Data transmission request command	

Data direction	Data type	Bytes
From PLC to module	Data transmission request command	1
Total from PLC to module		1
From module to PLC	Beams status or measurements	1 to 58
Module to PLC total		1 to 58

MI-Bx MODULES: ACYCLIC DATA

Acyclic data is listed in the table below:

Data	Notes
System I/O	Not available
I/O diagnostics	Not available
System errors (if a fault is present)	Available with firmware version ≥3.0.0
CRC program loaded on M1/M1S	Not available
Analogue measurement with floating-point format	Not available
Data transmission request command	
RFID sensor data	Not available

MI-Bx MODULES: GENERAL INFORMATION

The process map provides the beam status or the barrier measurements. The map can range from a minimum of 1 byte up to a maximum of 58 bytes. The BITs of each byte represent the status of each beam or measurement, depending on how the Micron barrier was configured by the user.

The barrier can be configured to start the measurements after a "Data transmission request command"; the command is received from the PLC as a byte. The byte to be received is configured through of the "Micron Configurator" software.

For a description of the process data mapping of your fieldbus, refer to chapter "*PROCESS MAPS*".

BUS CONFIGURATOR

The bus module is connected to the configuration PC via the USB "C" or "mini-USB" interface located on the front panel. Configuration is performed with the "Bus Configurator - User interface" software that can be downloaded from the ReeR website.

Starting from version 5.0.0, the software is supplied in two versions:
- a version for installations where the module is connected to a M1/M1S Master
- a version for installations where the module is connected to a Micron barrier

GRAPHIC USER INTERFACE

The software user interface is different depending on the connected BUS module. Text menu commands and control buttons are the same.

User interface for MBx modules

If the BUS module connected to the PC belongs to the MBx series, then the user interface will be similar to the following image.
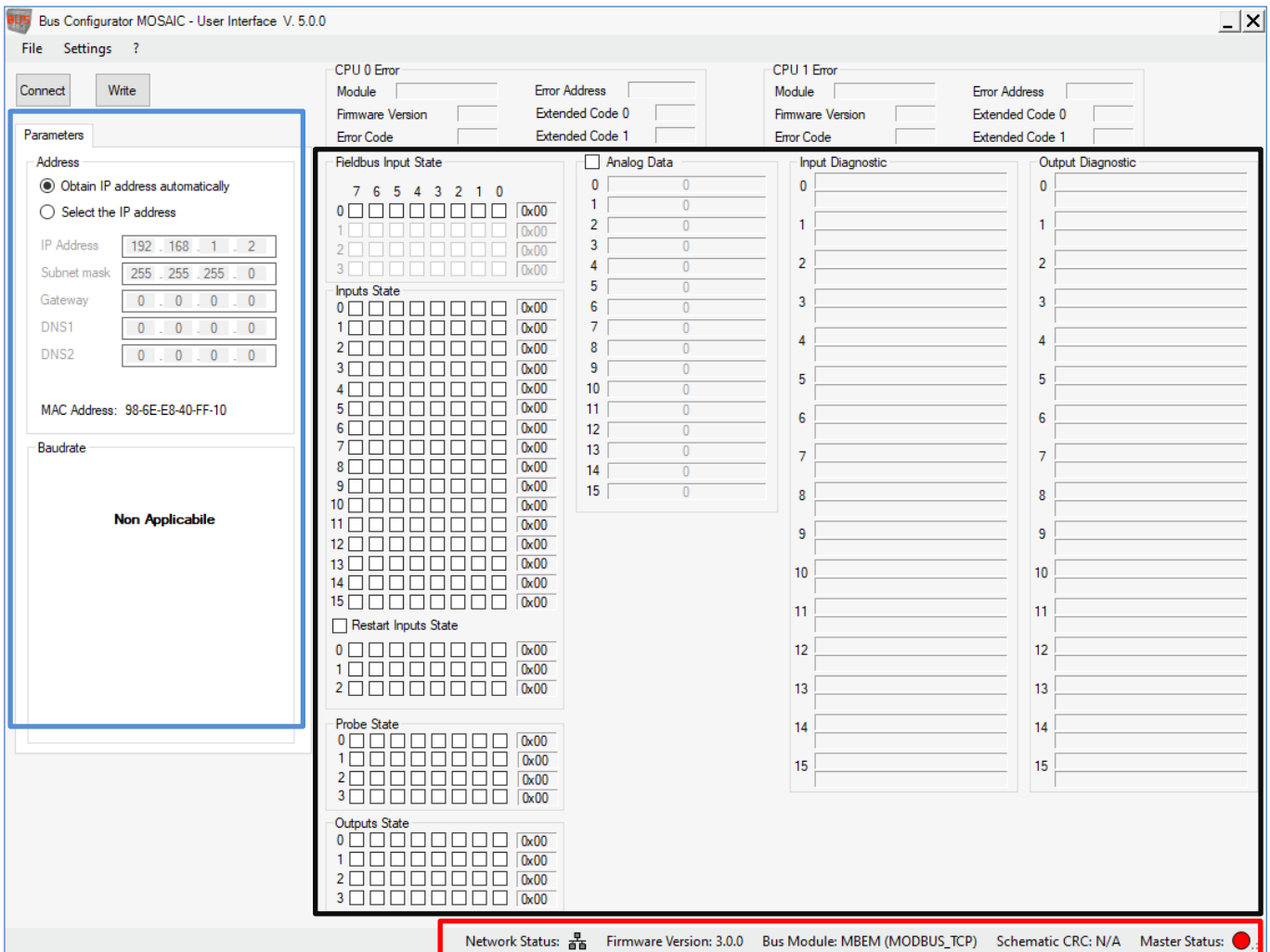
At the top right there are the boxes "CPU Error 0" and "CPU Error 1", which show the error information if Mosaic module fails.

The box highlighted in black contains information about the inputs and outputs, together with diagnostics.

It should be noted that next to the "Restart Input Status" and "Analogue Data" tags there are two checkboxes: by checking them, the user can select whether to insert them or not in the process map.

The box highlighted in blue shows the network parameters and settings that are specific to each stack and in particular:

Stacks	Enable DHCP	Fixed network parameters	Station name	Baud rate
EtherNet/IP	YES	YES	YES	YES
Modbus TCP	YES	YES	NO	NO
PROFINET	NO	YES	YES	NO
EtherCAT	NO	NO	YES	NO

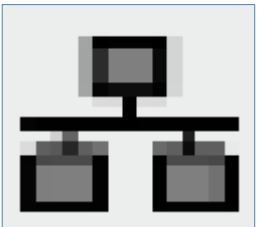At the bottom right (red rectangle) there are five types of information:

- **network status**
  - *EtherNet/IP stack:* it indicates whether there is or not a network connection if the PLC is not connected. When the PLC is connected to the module, then it indicates the presence or not of the connection to the PLC.
  - *Modbus TCP stack:* it indicates whether there is or not a network connection if the PLC is not connected. When the PLC is connected to the module, then it indicates the presence or not of the connection to the PLC.
  - *PROFINET stack:* it indicates whether there is or not a network connection if the PLC is not connected. When the PLC is connected to the module, then it indicates the presence or not of the connection to the PLC.
  - *EtherCAT stack:* this icon is not present

Network Status icon colours when network or PLC is present:
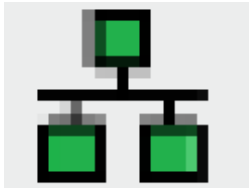
Network Status icon colours when network or PLC is not present:
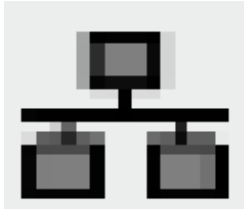
- **Firmware version:** it indicates the firmware version of the bus module
- **BUS module:** it indicates if the BUS module is connected to the USB port and if so, it indicates the type of connected module (if the "Connect" button was pressed)
- **CRC Diagram:** it indicates the CRC of the program loaded on the M1S Master
- **Master Status:** it indicates the status of the connection with the M1/M1S Master. Possible statuses:
  - ⬤ grey: MBx is not connected
  - ⬤ orange: MBx is receiving/sending the configuration from/to the Bus configurator
  - ⬤ green: Master is active (RUN)
  - ⬤ red: Master is not active (e.g., communication with Designer)

User interface for MI-Bx modules

If the BUS module connected to the PC belongs to the MI-Bx series, then the user interface will be similar to the following image.
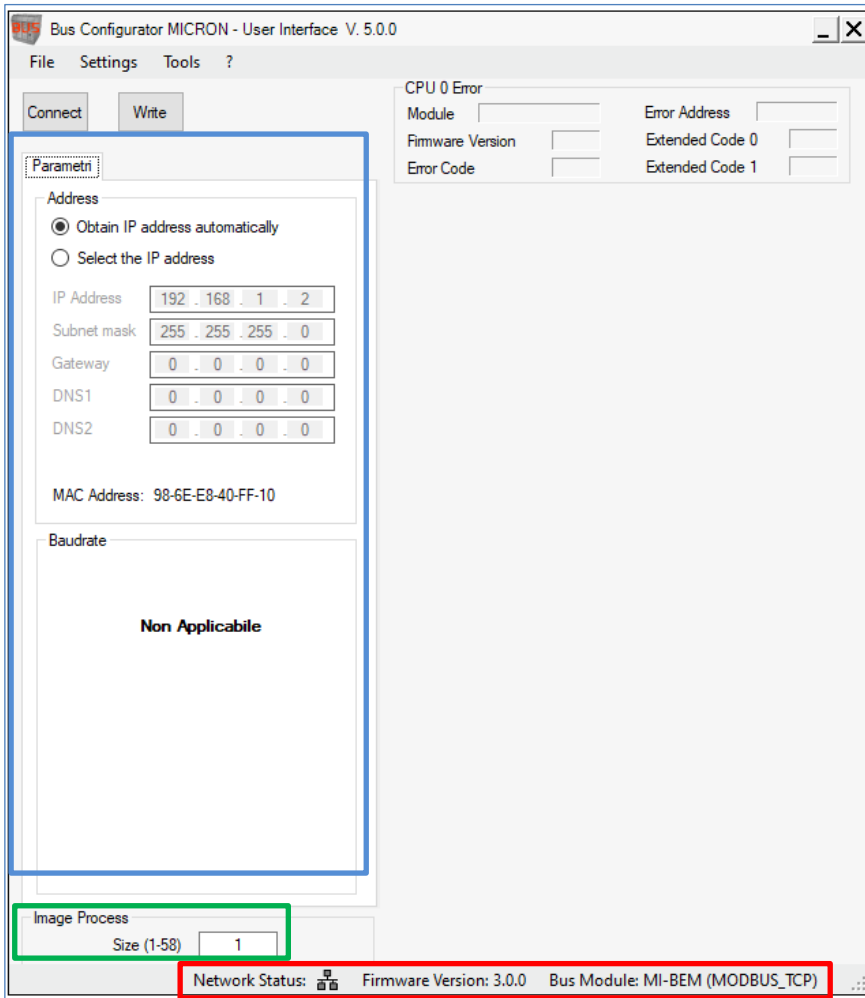
At the top right, there is the "CPU Error 0" box which shows the error information if the Micron barrier fails.

The box highlighted in blue shows the network parameters and settings that are specific to each stack and in particular:

Stacks	Enable DHCP	Fixed network parameters	Station name	Baud rate
EtherNet/IP	YES	YES	YES	YES
Modbus TCP	YES	YES	NO	NO
PROFINET	NO	YES	YES	NO
EtherCAT	NO	NO	YES	NO

The interface has a "Process Map" box (green rectangle) where it is possible to select the size of the process map to be received from the Micron barrier

At the bottom right (circled in red) there are five types of information:

- **network status**
  - o *EtherNet/IP stack:* it indicates whether there is or not a network connection if the PLC is not connected. When the PLC is connected to the module, then it indicates the presence or not of the connection to the PLC.
  - o *Modbus TCP stack:* it indicates whether there is or not a network connection if the PLC is not connected. When the PLC is connected to the module, then it indicates the presence or not of the connection to the PLC.
  - o *PROFINET stack:* it indicates whether there is or not a network connection if the PLC is not connected. When the PLC is connected to the module, then it indicates the presence or not of the connection to the PLC.
  - o *EtherCAT stack:* this icon is not present.

Network Status icon colours when network or PLC is present:

Network Status icon colours when network or PLC is not present:

- **Firmware version:** it indicates the firmware version of the bus module
- **BUS module:** it indicates if the BUS module is connected to the USB port and if so, it indicates the type of connected module (if the "Connect" button was pressed)

CONNECT BUTTON (COMMAND)

The Connect button is available as soon as a powered BUS module is connected to the configuration PC via a USB cable.
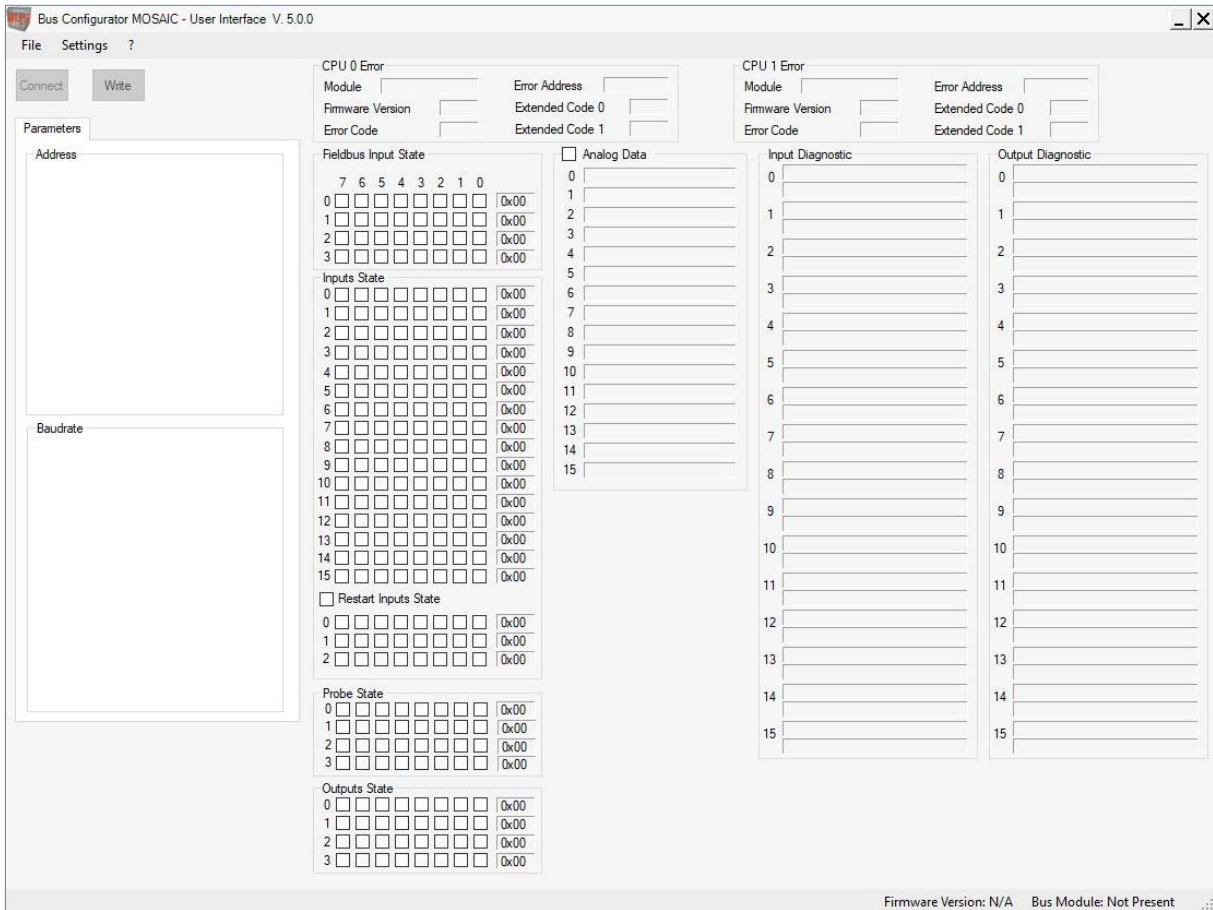
Figure 4 - Software interface without the BUS module.

➡ The Connect button is not available, the "BUS Module" label at the bottom right shows the module as "Not Present".

When pressed, an animated GIF (Figure 5) will appear showing it is waiting for a successful communication between the module and the BUS Configurator software.
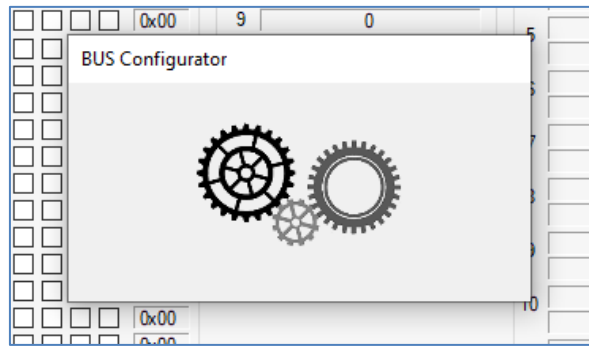
Figure 5

If the communication is successful:

1) information regarding the network configuration, network status, module status and process map status will be received (i.e., if "Analogue data" or "Restart Input Status" have been previously selected).

2) the monitor will automatically start enabling the process data cyclical reception from the BUS module. The data will populate the BUS Configurator software interface.
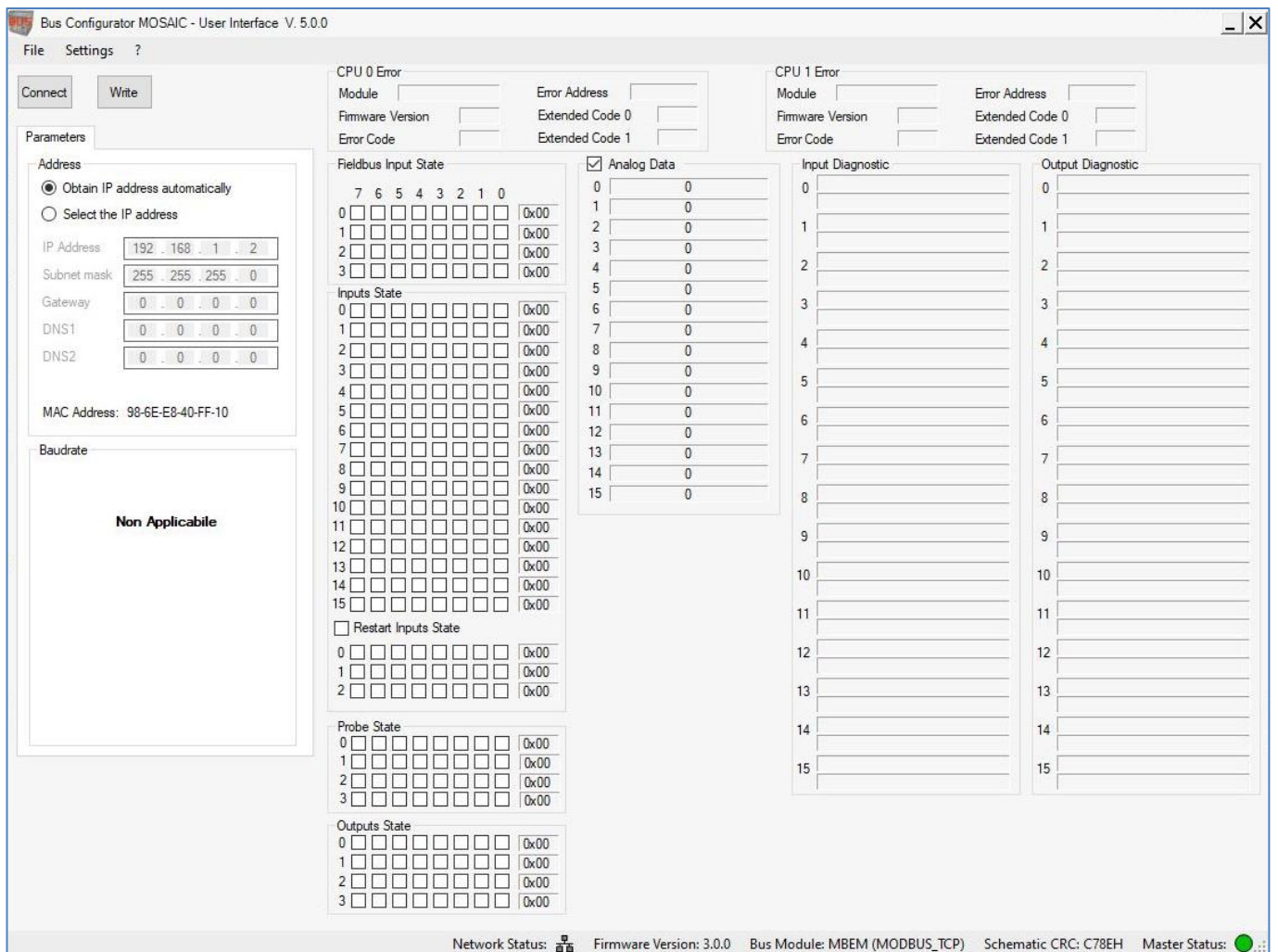
Figure 6 - Software interface with the BUS module connected and working.

WRITE BUTTON (COMMAND)
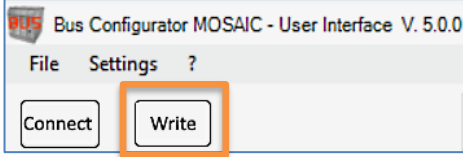
The Write button is used to write the configuration on the module. The configuration concerns the network and the process map parameters (either fixed or in backwards-compatible mode).

The configurable network parameters depend on the type of stack installed.

The process map parameters regard:
- in the case of fixed maps, the presence or absence of the "Restart Input Status" and the "Analogue data"
- in the case of variable maps, the size of the map itself.

When the button is pressed, if the parameters are correct, an animated GIF will appear indicating that the BUS Module is being saved.
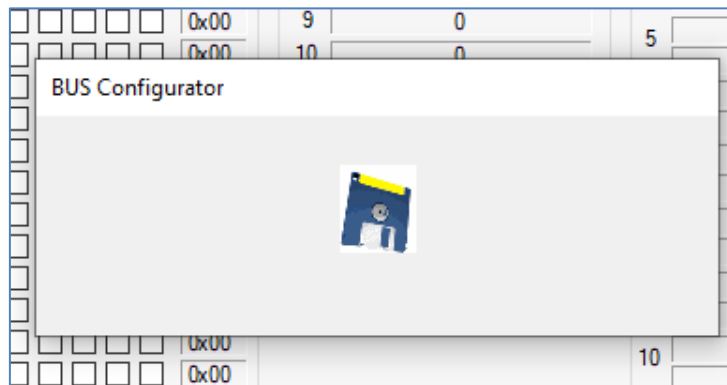
Figure 7

If saving was successful, the following image will appear
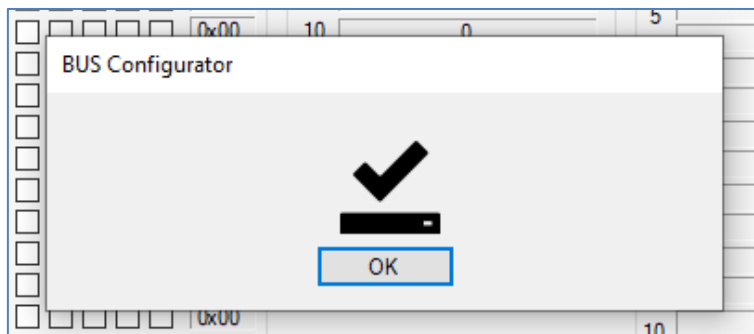
Figure 8

FILE MENU

Open Command
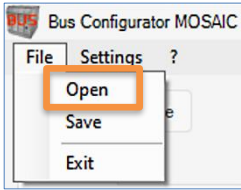
This command is used to open a previously saved configuration from a file.

Save Command
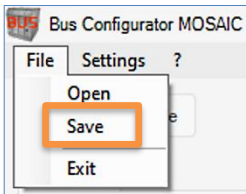
This command is used to save the current configuration of the BUS module on a file.

Exit Command
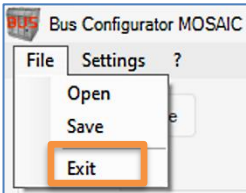
This command is used to exit the software and close.

SETTING MENU

Select Language Command
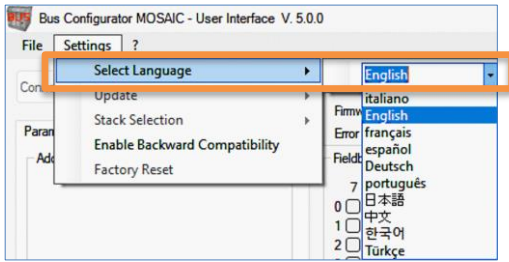
This command is used by the user to change the language of the software.

Update Command (Firmware, Eeprom, Firmware Network)
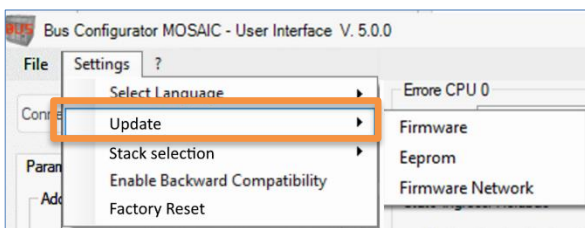
➡ Warning: The Update -> Firmware Network command is only available for BUS modules with firmware ≥ 3.0.0

This command is used to update the BUS module firmware. Namely:

- **Update → Firmware:** selecting the firmware file, if the file is correct, the firmware update of the main microcontroller is performed
- **Update → Eeprom:** selecting the EEPROM memory file, if the file is correct, its content is written on the EEPROM memory of the main microcontroller.
- **Update → Firmware Network:** selecting the .ZIP file which must be in the format "FWUPDATE_NNNN.ZIP", where NNNN shows the version of the file, if the file is correct, the firmware and/or the network controller stack contained in the "FWUPDATE_NNNN.ZIP" file is updated.

Select Stack Command
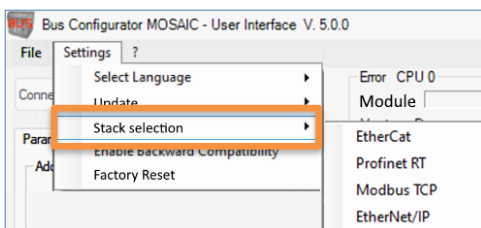
This command is used to select the stack installed on the BUS Module.

➡ ATTENTION: this command is enabled exclusively for the MBECOM and MI-BECOM modules.

➡ ATTENTION: this command is only available for BUS modules with firmware ≥ 3.0.0

The software autonomously recognizes the type of connected module and enables or not this command according to the detected module.
Progress is displayed when the command is performed.
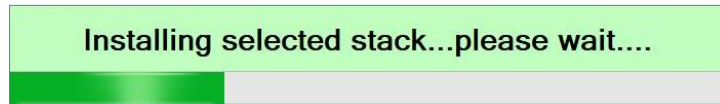
Figure 9

If the command has been performed successfully, the following image will appear
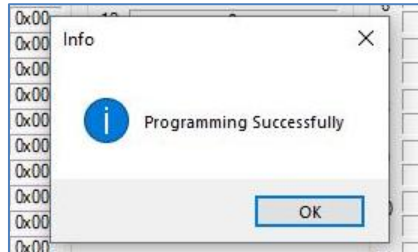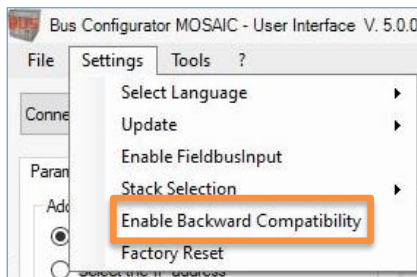

Figure 10

Enable Backward Compatibility Command

➡ Backward compatibility mode allows the operator to use the MSD software with a M1 master module with a firmware version < 5.0.0.

When the command is performed, a pop-up window will show the following message:

A new "Backward compatibility" tab will then appear (see Figure 11) enabling the user to choose the subsection to be exported to the fieldbus (ref. Figure 11) by changing the size of each process map and, therefore, the size used in the physical memory of the PLC.

When the module is connected, all data is displayed in the main software window.
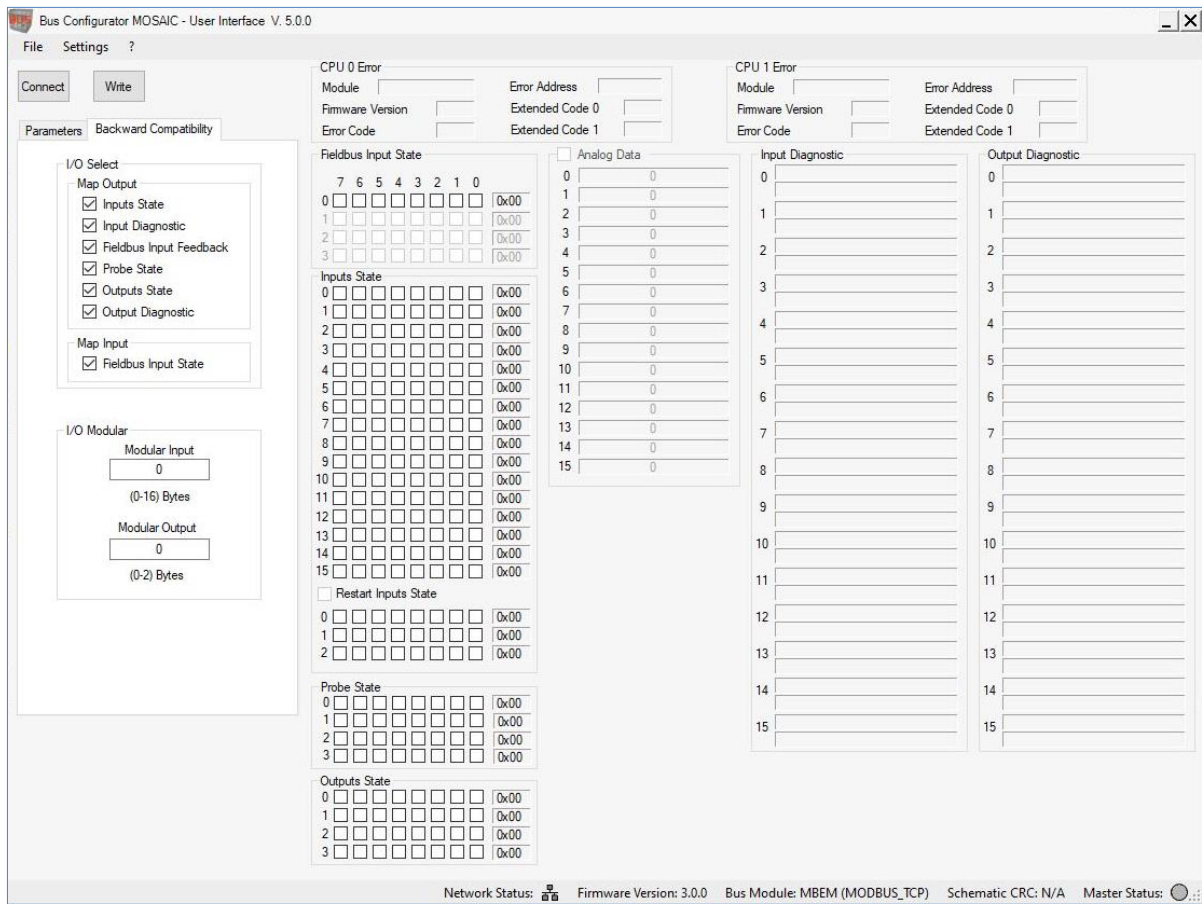
Figure 11 – Backward compatibility

Each of the following sets of information:

- "Input Status"
- "Input Diagnostics"
- "Fieldbus Input Feedback"
- "Probe State" (Probes)
- "Output State" (OSSD)
- "Output Diagnostics"
- "Fieldbus Input State"

can be enabled/disabled to control the type of information to be exported to the fieldbus.

In the "Modular Inputs" and "Modular Outputs" sections, the user can define respectively the number of bytes of the "Input Status" set and the number of bytes of the "Output Status" set exported to the fieldbus.

➔ Warning: if zero is entered in the "Modular Inputs" or "Modular Outputs" box, then the size of the "Input Status" and "Output Status" sets depends directly on the number of inputs and outputs present in the program loaded on the M1 Master.

When the configuration data are set, the operator must press the "Write" button to send them to the module.

Process map in backwards compatibility (version for M1 fw < 5.0.0)

The backwards compatibility mode allows the Bus module to use the variable process map. This allows to replace an existing Bus module without modifying the PLC program.

➡ The backwards compatibility mode only works if the Bus module is connected to an M1 Master module. If a Bus device is configured in backwards-compatibility mode and connected to an M1S, the Bus module will fail.

System status, I/O status and I/O diagnostics are available in the cyclic process map.

The process map contains the sets of the information listed in the previous paragraph, which are repeated for clarity along with their possible size.

Data direction	Data type	Bytes
From PLC to module	Fieldbus input status	1
Total from PLC to module		1
From module to PLC	System status (status byte)	1
From module to PLC	Input status	1 to 16
From module to PLC	Input diagnostics	2
From module to PLC	Fieldbus input feedback	1
From module to PLC	Probe status (Probes)	2
From module to PLC	Output status (OSSD)	1 to 2
From module to PLC	Output diagnostics	2
Module to PLC total		variable

The "Fieldbus inputs state" set allows the PLC to cyclically send up to eight ON/OFF statuses that are used as non-safe inputs in the Mosaic program.

In the status byte, the system status BITs are described in the following table

Status bytes	
BIT	**BIT value meaning**
7	-
6	-
5	-
4	-
3	-
2	-
1	0: no diagnostics 1: diagnostics
0	0: Master not available 1: Master available

➡ The troubleshooting sections report significant data if BIT 1 in the status byte is set to 1.

The section dedicated to the **input status** regards the status of max 128 inputs. The priority order of modules is the following:

- **M1, MI8O2, MI16, MI8, MI12, MV2, MV1, MV0.**

The section dedicated to **safety output status** regards the status of max 16 outputs. The priority order of modules is the following:

- **M1, MI8O2, MO2, MO4, MOR4, MOR4S8, MO4LHCS8.**

If two or more modules of the same type are installed, the one with the lowest node number is displayed first.

Each module equipped with inputs has a number of BITs corresponding to the number of physical inputs; M1, MI8, MI8O2 modules will therefore use 1 byte, and MI12T8 and MI16 modules will use 2 bytes. MV0, MV1 and MV2 modules will use 1 byte each.

In fieldbuses where the assignment is important (e.g., PROFIBUS, PROFINET) the fieldbus input bytes must be mapped before the output bytes.

If a fieldbus module is present in the Mosaic system, MSDesigner will include in the report a table showing the I/O index of all the inputs, fieldbus inputs, probes, and safety outputs of the wiring diagram.

The diagnostics items will use 2 bytes indicating the number of the I/O showing the diagnostics and the value of the diagnostics item. If there is more than one diagnostics item, the relevant values alternate every 500ms.

The input and output process map definition is shown from the Mosaic perspective.

Factory Reset Command
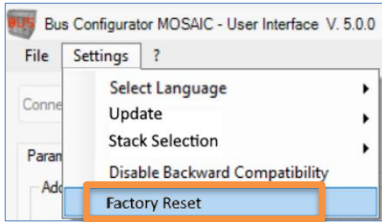
This command is used to reset the network parameters and process map parameters to the factory default settings.

For example, if the module process map was configured with "Analogue Data", after a "Factory Reset" it will go back to being without "Analogue Data".

Confirmation is requested before performing the command.
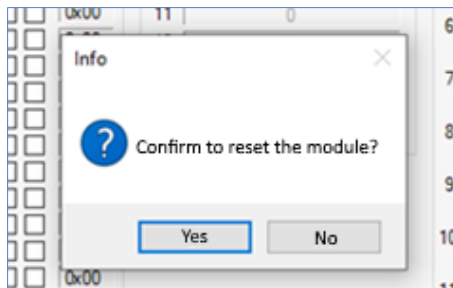
Figure 12 - Module Reset Confirmation Request

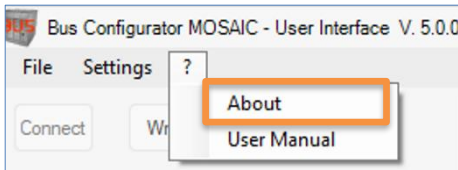If the reset was successful, a window will appear confirming it.
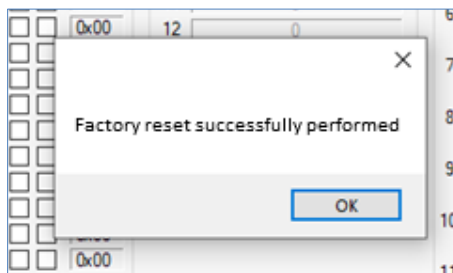
Figure 13 - Successful Factory Reset

"?" MENU

"About…" Command

When this command is performed, a window is displayed that summarizes some information about the currently connected module.
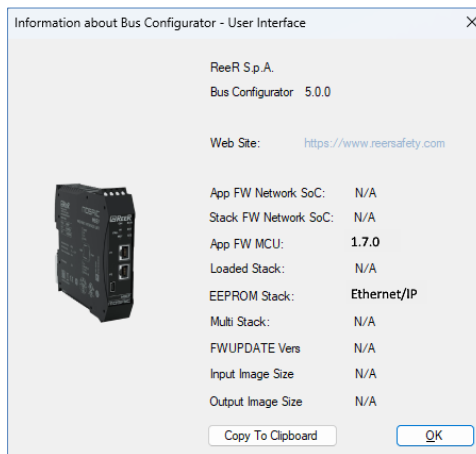
Figure 14

Namely:
- **App fw Network SoC:** firmware version of the network controller (if available)
- **Stack fw Network SoC:** version of the network stack (if available)
- **App fw MCU:** main microcontroller firmware version (if available)
- **Loaded Stack:** stack actually loaded on the network controller (if available)
- **EEPROM Stack:** type of stack which the module has been configured with (if available)
- **Multi Stack:** it indicates if the module is multi-stack or not (if available)
- **FWUPDATE Vers:** it indicates the version of the binary image loaded on the network controller (if available)
- **Input Image Size:** it indicates the size (in bytes) of the data transferred from the PLC to the BUS module via network/fieldbus (if available)
- **Output Image Size:** it indicates the size (in bytes) of the data transferred from the BUS module to the PLC via network/fieldbus (if available)

The "Copy to Clipboard" button is used to copy all the information described above to the "clipboard" of the PC that the module is connected to.

➡️   Attention: the information displayed will be available exclusively after performing the "Connect" command.

User Manual Command
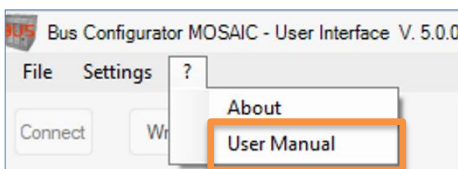
It is used to open this manual in PDF format.

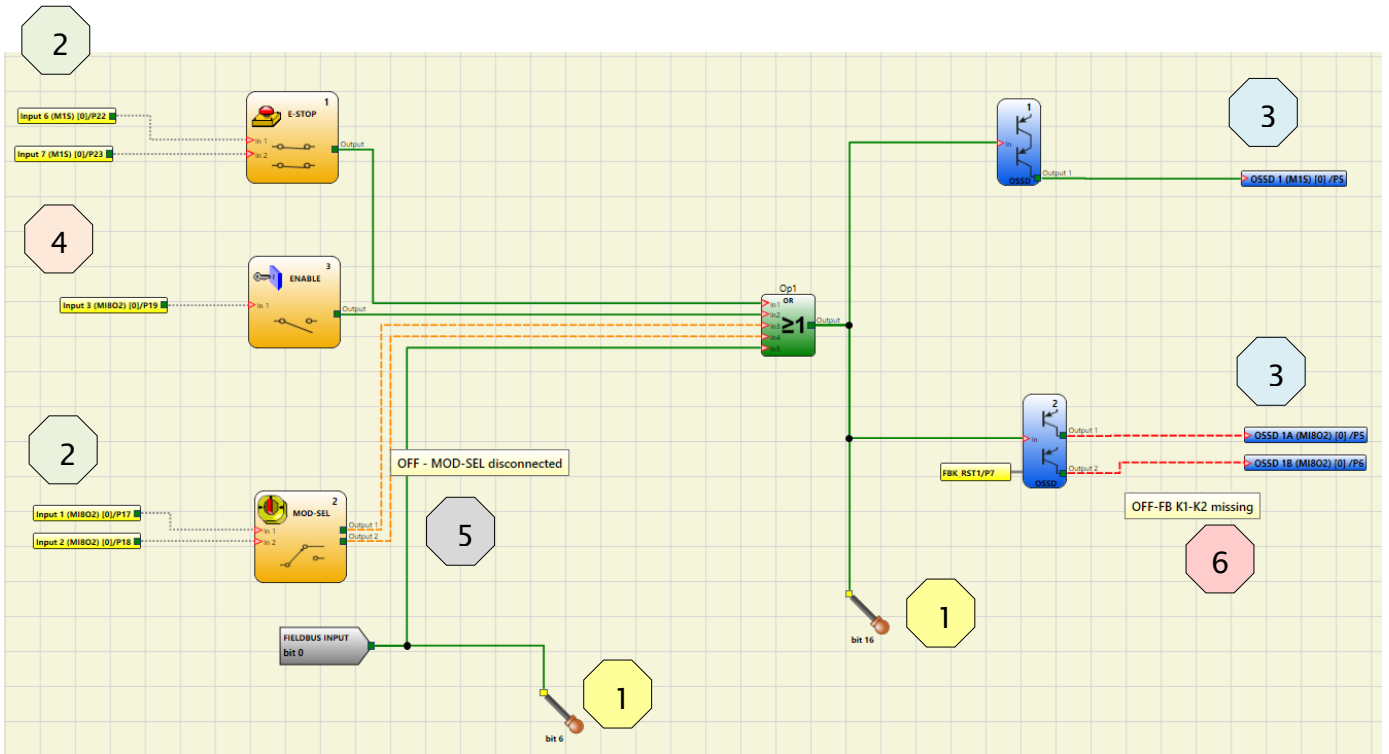# MSD CONFIGURATION EXAMPLES AS SHOWN BY THE BUS CONFIGURATOR

Figure 15 – Example of a project on MSD

Figure 16

- E-STOP input 1 is connected to screws 6 and 7 on M1/M1S. Its status (zero or one) is contained in BIT 5 of byte 0 reserved for inputs. BIT 6 is always set to zero: it is kept fixed to signal that the E-STOP occupies two screws on M1/M1S.
- ENABLE input 2 is connected to screw 8 on M1/M1S. Its status (zero or one) is contained in BIT 7 of byte 0, reserved for M1/ M1S inputs.
- MOD-SEL input 3 is connected to screws 1 and 2 on MI802 with diagnostics indicating that MOD-SEL is disconnected. Its status is contained in BIT 0 and 1 of byte 1, reserved for MI802 inputs. The diagnostics are displayed in the section reserved for input diagnostics with index 2 and the related diagnostics.
- Probes on BITs 6 and 8 are green and the related BITs in the Probe section are selected. Probe 8 is contained in BIT 0 of the second byte.
- OSSD 1 is ON and is connected to the second pair of M1/M1S outputs. Its status is contained in BIT 1 of byte 0, reserved for outputs.
- OSSD 2 is OFF with diagnostics indicating that is waiting for restart, and it is connected to the second pair of MI802 outputs. Its status is contained in BIT 2 of byte 0, reserved for outputs. The diagnostics are displayed in the section reserved for OSSD diagnostics with index 2 and the related diagnostics.
- In the Fieldbus input section, BIT 0 is selected so that the fieldbus input on BIT 0 is green in the MSD project.

INPUT STATUS OF THE MV MODULES

From MV module with Firmware >= 3.0.0, the output data (in the "Input Status" of the process map) will follow the following diagram:
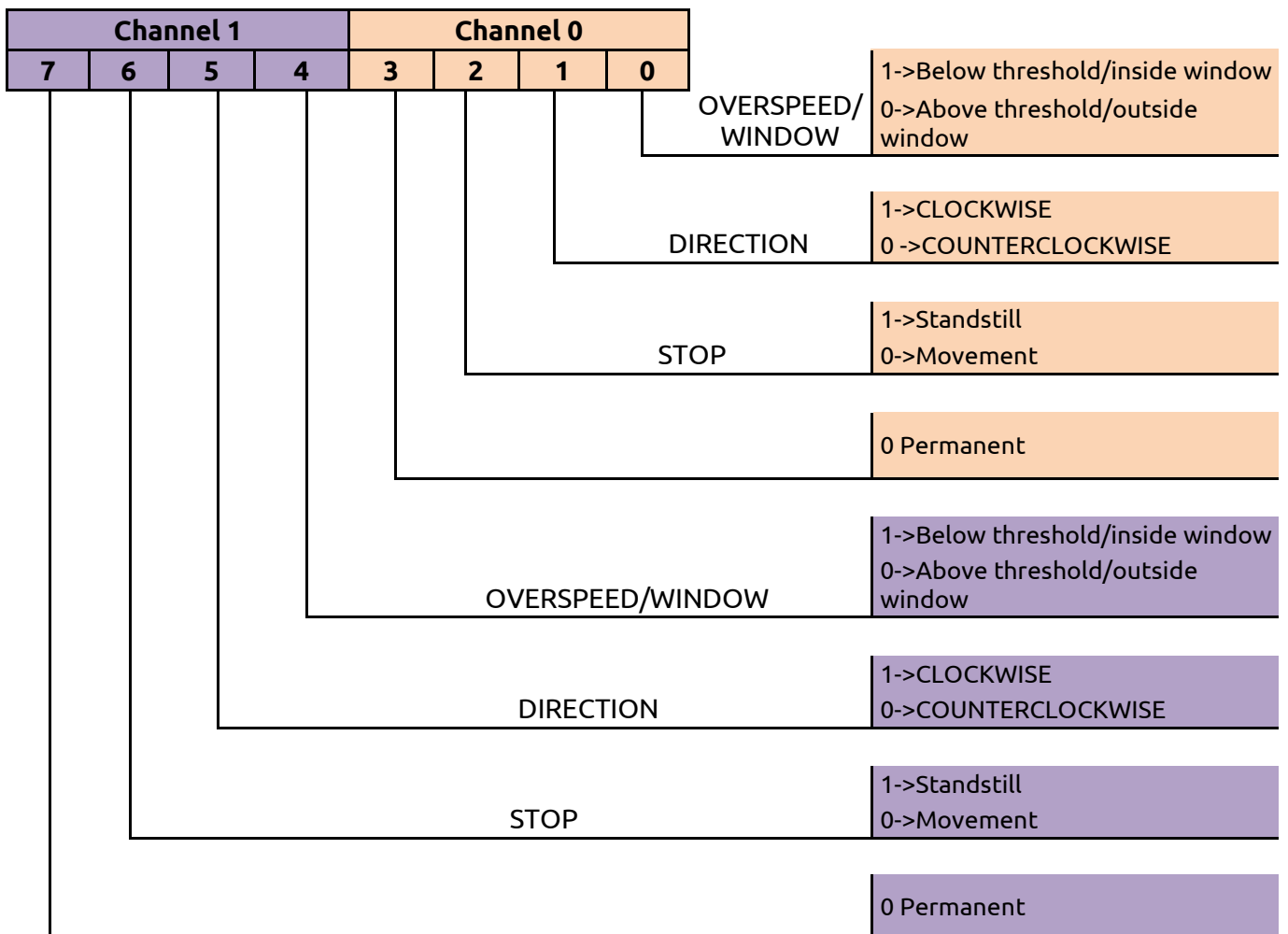
PROCESS MAPS

To examine the process map in question, read the document *"8547782 - PROCESS DATA MAPPING"* which can be downloaded from the website "www.reersafety.com"