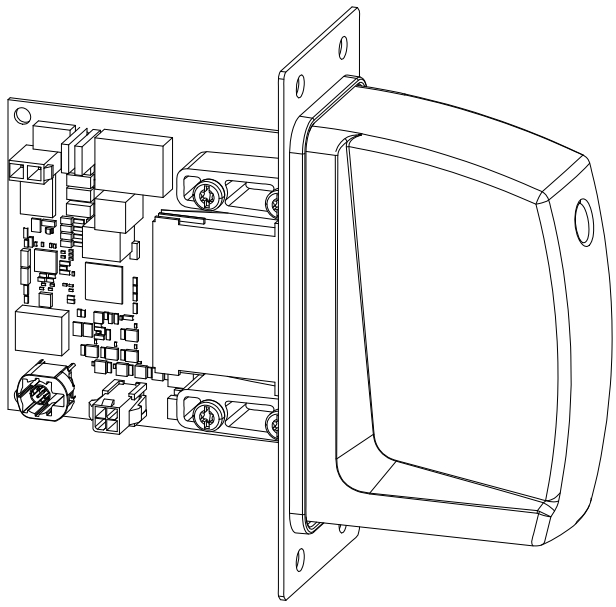
Operating Instructions

RI FB/i Automation V1.0
RI MOD/i CC Powerlink
RI MOD/i CC ProfiNet IO-2P
RI MOD/i CC Modbus TCP-2P



EN-US | Operating instructions

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Table of contents

General ... 5
Safety ... 5
Device Concept ... 5
Block diagram ... 6
Scope of supply ... 6
Required Tools and Materials ... 6
Installation Requirements ... 6
Connection Sockets and Indicators on the Robot Interface ... 7
Connections on the Robot Interface ... 7
LEDs on Robot Interface PCB ... 7
LEDs for Power Supply Diagnosis ... 8
LEDs for Network Connection Diagnosis ... 9
Connections and indicators on the bus module - Powerlink ... 10
Connections and indicators ... 10
Connections and indicators on the bus module - ProfiNet IO-2P ... 12
Connections and indicators on RJ 45 module ... 12
Connections and indicators on the bus module - Modbus TCP-2P ... 14
Connections and indicators on RJ 45 module ... 14
Powerlink technical data ... 16
Environmental Conditions ... 16
Robot Interface Technical Data ... 16
Data transfer properties ... 16
Configuration parameters ... 16
ProfiNet IO-2P technical data ... 18
Environmental Conditions ... 18
Robot Interface Technical Data ... 18
Data transfer properties ... 18
Configuration parameters ... 18
Modbus TCP-2P technical data ... 20
Environmental Conditions ... 20
Robot Interface Technical Data ... 20
Data transfer properties ... 20
Configuration parameters ... 20
Configuring the robot interface - Powerlink ... 22
General ... 22
Setting the process image ... 22
Setting the node address with dip switch(example) ... 22
Configure node address ... 23
Configuring the robot interface - ProfiNet IO-2P ... 24
General ... 24
Setting the process image ... 24
Setting the node address with dip switch(example) ... 24
IP Settings ... 25
Configuring the robot interface - Modbus TCP-2P ... 26
General ... 26
Setting the process image ... 26
Setting the IP address ... 26
Installing the Robot Interface ... 28
Safety ... 28
Preparation ... 28
Routing the Data Cable ... 29
Installing the Robot Interface ... 30
Final Tasks ... 30
Installing the Bus Module ... 31
Safety ... 31
Installing the Bus Module ... 31
Input and output signals - standard image Automation V1.0 ... 32
Data types ... 32
Availability of input signals ... 32
Input signals (from robot to power source) ... 32

Value range for Working mode ... 39
Value Range for TWIN Mode ... 40
Value range for Documentation mode ... 40
Availability of the output signals ... 41
Output signals (from power source to robot) ... 41
Assignment of Sensor Statuses 1–4 ... 46
Value range for Function status ... 46
Value range Safety status ... 46
Value Range for Process Bit ... 46
TAG Table ... 47
Value range for TAG number 1 (Cooling unit mode) ... 49
Value range for TAG number 11 (Arc break monitoring) ... 49
Value range for TAG number 35 (Language) ... 49
Value range for TAG number 36 (Unit - metric/imperial) ... 50
Value range for TAG number 37 (Welding standard - AWS/EU) ... 50
Input and output signals Weldcom V2.0 ... 51
Data types ... 51
Input Signals ... 51
Value range Process line selection ... 54
Value Range for TWIN Mode ... 54
Value Range for Documentation mode ... 55
Value range for Working mode ... 55
Value Range for Command value selection ... 55
Output Signals ... 56
Value range for welding process and process image ... 58
Assignment of Sensor Statuses 1–4 ... 59
Value range Safety status ... 59
TAG table ... 59
Input and output signals - retrofit image Weldcom TPS series ... 62
Input signals ... 62
Value Range for Operating Mode ... 64
Output signals ... 65
TAG Table ... 66
Modbus – General Information ... 68
Protocol Description ... 68
Data Coding ... 68
Application Data Unit (ADU) ... 69
Modbus Functions ... 70
03 (03) Read Holding Register ... 70
06 (06) Write Single Register ... 71
16 (10) Write Multiple Register ... 73
23 (17) Read/Write Multiple Register ... 75
103 (67) Read Holding Register Float ... 76
104 (68) Write Single Register Float ... 77

General

Safety

⚠ WARNING!

Danger from incorrect operation and work that is not carried out properly.
This can result in serious personal injury and damage to property.
- ▶ All the work and functions described in this document must only be carried out by technically trained and qualified personnel.
- ▶ Read and understand this document in full.
- ▶ Read and understand all safety rules and user documentation for this equipment and all system components.

⚠ WARNING!

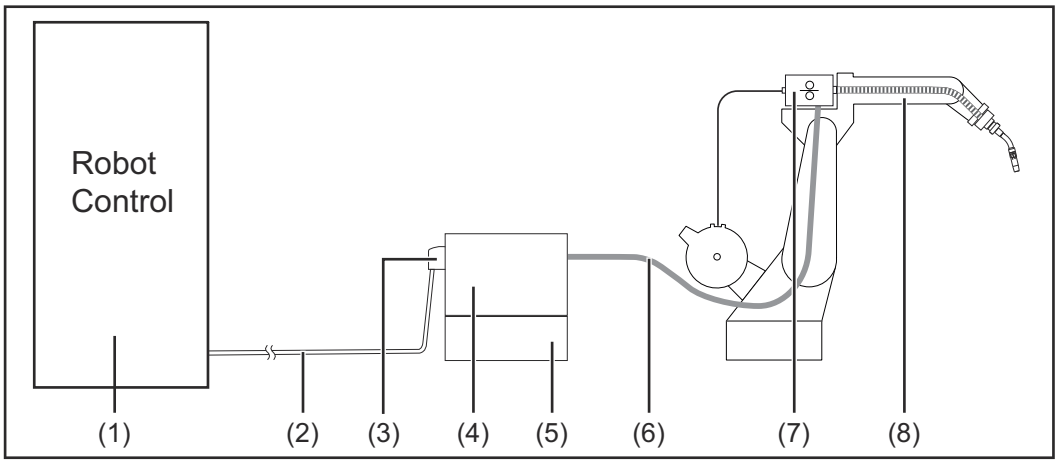
Danger from electrical current.
This can result in serious personal injury and damage to property.
- ▶ Before starting work, switch off all the devices and components involved and disconnect them from the grid.
- ▶ Secure all devices and components involved so they cannot be switched back on.

⚠ WARNING!

Danger from unplanned signal transmission.
This can result in serious personal injury and damage to property.
- ▶ Do not transfer safety signals via the interface.

Device Concept

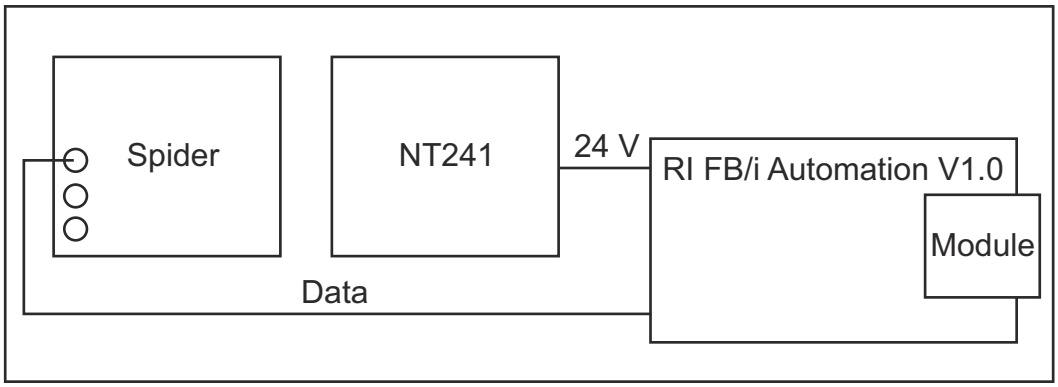
The robot interface serves as an interface between the power source and standardized bus modules supporting a wide range of communication protocols. Fronius may factory-fit the robot interface in the power source but it can also be retrofitted by appropriately trained and qualified personnel.



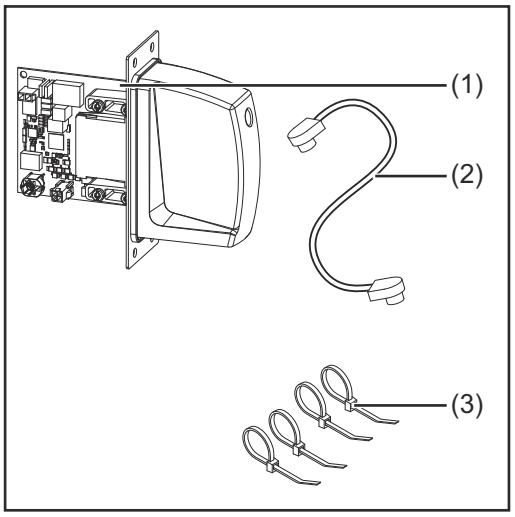
(1)	**Robot control system**
(2)	**SpeedNet data cable**
(3)	**Robot interface**

(4)	**Power source**
(5)	**Cooling unit**
(6)	**Interconnecting hosepack**
(7)	**Wirefeeder**
(8)	**Robot**

Block diagram



Scope of supply



(1)	**RI FB/i Automation V1.0**
(2)	**Data cable 4-pin**
(3)	**2x cable ties**
(4)	**These Operating Instructions (not pictured)**

Required Tools and Materials

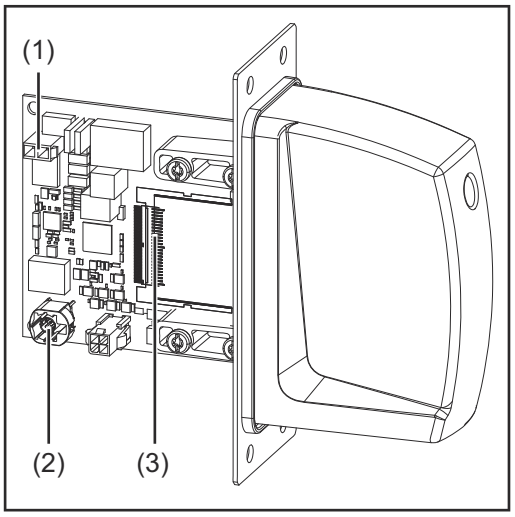
- Screwdriver TX8
- Screwdriver TX20
- Screwdriver TX25
- Diagonal cutting pliers

Installation Requirements

The robot interface may only be installed in the designated opening on the rear of the power source.

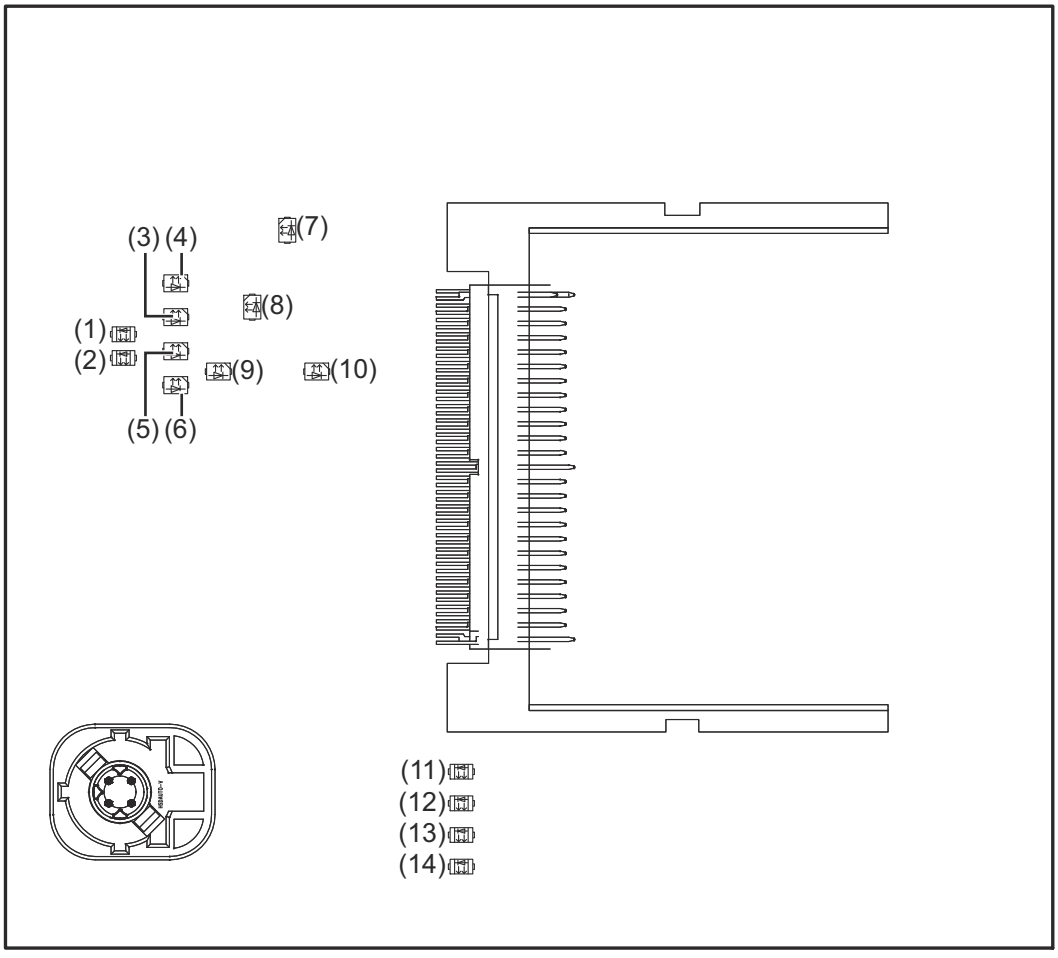
Connection Sockets and Indicators on the Robot Interface

Connections on the Robot Interface



(1)	**Power supply connection 2-pin**
(2)	**SpeedNet data cableconnection 4-pin**
(3)	**Bus module connection**

LEDs on Robot Interface PCB



(1)	ETH1 LED	Green	For diagnosing the network connection. For details, see section below titled "LEDs for Network Connection Diagnosis"
(2)	ETH2 LED	Orange	
(3)	LED 3	Green	No function
(4)	LED 4	Green	
(5)	LED 5	Green	- Flashes at 4 Hz = No SpeedNet connection - Flashes at 20 Hz = Establishing SpeedNet connection - Flashes at 1 Hz = SpeedNet connection established
(6)	LED 6	Red	Lights up when an internal error occurs. Remedy: Restart the robot interface. If this does not resolve the issue, inform the service team.
(7)	+3V3 LED	Green	For diagnosing the power supply. For details, see section below titled "LEDs for Power Supply Diagnosis"
(8)	+24V LED	Green	
(9)	DIG OUT 2 LED	Green	Digital output 2. LED lights up when active
(10)	DIG OUT 1 LED	Green	Digital output 1. LED lights up when active
(11)	LED 11	Green	No function
(12)	LED 12	Green	
(13)	LED 13	Green	
(14)	LED 14	Green	

LEDs for Power Supply Diagnosis

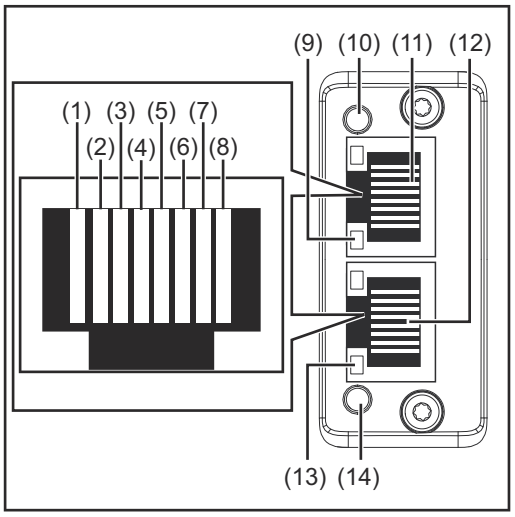
LED	Indicator	Meaning	Cause
+24V	Off	No supply voltage available for interface	- Robot interface power supply not established - Power supply cable faulty
	Lights up	24 VDC supply voltage present on robot interface	
+3V3	Off	No operating voltage present on robot interface	- 24 VDC supply voltage not present - Robot interface power supply unit is faulty
	Lights up	3 VDC operating voltage present on robot interface	

LEDs for Network Connection Diagnosis

LED	Indicator	Meaning	Cause
ETH1	Off	No network connection	- No network connection established for interface - Network cable faulty
	Lights up	Network connection established	
	Flashes	Data transfer in progress	
ETH2	Off	Transmission speed 10 Mbit/s	
	Lights up	Transmission speed 100 Mbit/s	

Connections and indicators on the bus module - Powerlink

Connections and indicators



(1)	TX+
(2)	TX-
(3)	RX+
(6)	RX-
(4)	Not normally used; to ensure signal completeness, these pins must be interconnected and, after passing through a filter circuit, must terminate at the ground conductor (PE).
(5)	
(7)	
(8)	
(9)	Connection/activity at connection 2 LED
(10)	LED Error (network status)

(11)	RJ45 connection 2
(12)	RJ45 connection 1
(13)	Connection/activity at connection 1 LED
(14)	LED Status (module status)

LED Status (module status)	
Status	**Meaning**
Off	Not initialized / not active
Flashes green quickly	NMT_CS_BASIC_ETHERNET No data traffic
Flashes green (once)	NMT_CS_PRE_OPERATIONAL_1 Asynchronous data only
Flashes green (twice)	NMT_CS_PRE_OPERATIONAL_2 Asynchronous and synchronous data. No PDO data: all process data are invalid. Received data are ignored.
Flashes green (three times)	NMT_CS_READY_TO_OPERATE Ready for operation. Asynchronous and synchronous data. No PDO data: all process data are invalid. Received data are ignored.
Lights up green	NMT_CS_OPERATIONAL Normal operation. Asynchronous and synchronous data. PDO data are received and sent.

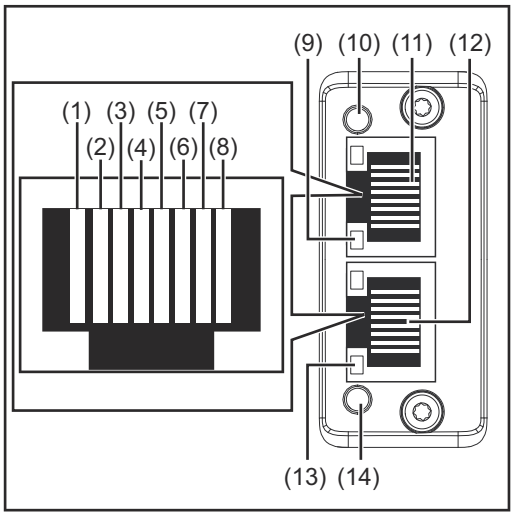
LED Status (module status)	
Status	**Meaning**
Flashes green slowly	NMT_CS_STOPPED Module stopped (for example, for decommissioning) Asynchronous and synchronous data. No PDO data: all process data are invalid. Received data are ignored.
Lights up red	Exception state, serious fault, etc.

LED Error (network status)	
Status	**Meaning**
Off	No error
Lights up red	Exception state, serious fault, etc.
Lights up	Error

Connection/activityLED	
Status	**Meaning**
Off	No connection
Lights up red	Connection established, no data traffic
Lights up	Connection established, data traffic present

Connections and indicators on the bus module - ProfiNet IO-2P

Connections and indicators on RJ 45 module



(1)	TX+
(2)	TX-
(3)	RX+
(6)	RX-
(4)	Not normally used; to ensure signal completeness, these pins must be interconnected and, after passing through a filter circuit, must terminate at the ground conductor (PE).
(5)	
(7)	
(8)	
(9)	Connection/activity LED, connection 2
(10)	MS LED (module status)

(11)	RJ-45 Ethernet connection 2
(12)	RJ-45 Ethernet connection 1
(13)	Connection/activity LED, connection 1
(14)	NS LED (network status)

Network Status LED	
Status	**Meaning**
Off	Offline; no power supply or no connection with IO Controller
Lights up green	Online (RUN); connection with IO Controller established, IO Controller in operation
Flashes green (once)	Online (STOP); connection with IO Controller established, IO Controller not in operation, IO data defective, IRT synchronization not ready
Flashes green (permanently)	In use by engineering tools in order to identify network nodes
Lights up red	The module has identified a serious internal fault
Flashes red (once)	Station name not set
Flashes red (twice)	IP address not set
Flashes red (three times)	Configuration error; expected identification does not match the actual identification

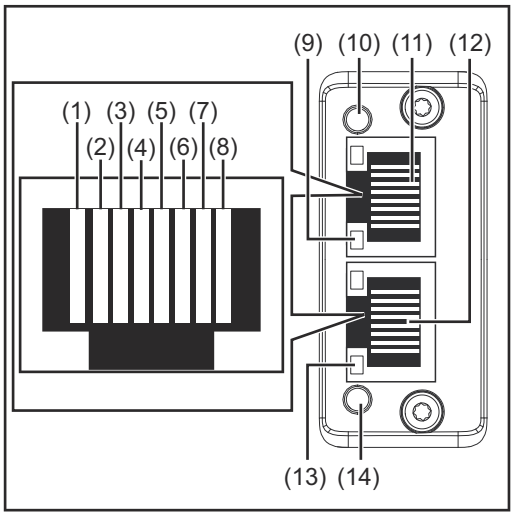
Module Status LED	
Status	**Meaning**
Off	No supply voltage or module in the setup or initialization mode

Module Status LED	
Status	**Meaning**
Lights up green	Normal operation
Flashes green (once)	Diagnosis process running
Lights up red	Emergency situation, serious fault, etc.
Lights up green and red alternately	Firmware update. Do not disconnect the module from the power supply during the update—this could result in damage to the module.

Connection/Activity LED	
Status	**Meaning**
Off	No connection, no activity
Lights up green	Connection established, no activity
Flickers green	Connection established, activity present

Connections and indicators on the bus module - Modbus TCP-2P

Connections and indicators on RJ 45 module



(1)	TX+
(2)	TX-
(3)	RX+
(6)	RX-
(4)	Not normally used; to ensure signal completeness, these pins must be interconnected and, after passing through a filter circuit, must terminate at the ground conductor (PE).
(5)	
(7)	
(8)	
(9)	Link/Activity LED 2
(10)	Module status LED

(11)	RJ-45 Ethernet connection 2
(12)	RJ-45 Ethernet connection 1
(13)	Link/Activity LED 1
(14)	Network status LED

Network Status LED:	
Status	**Meaning**
Off	No IP address or exception state
Lights up green	At least one Modbus message received
Flashes green	Waiting for first Modbus message
Lights up red	IP address conflict, serious error
Flashes red	Connection timeout. No Modbus message was received within the period defined for the "Process active timeout"

Module Status LED:	
Status	**Meaning**
Off	No supply voltage
Lights up green	Normal operation
Lights up red	Major error (exception state, serious fault, etc.)
Flashes red	Minor error
Alternates between red and green	Firmware update in progress

Link/Activity LED:	
Status	**Meaning**
Off	No connection, no activity
Lights up green	Connection established (100 Mbit/s)
Flickers green	Activity (100 Mbit/s)
Lights up yellow	Connection established (10 Mbit/s)
Flickers yellow	Activity (10 Mbit/s)

Powerlink technical data

Environmental Conditions

⚠ CAUTION!

A risk is posed by prohibited environmental conditions.
This can result in severe damage to equipment.
▶ Only store and operate the device under the following environmental conditions.

Temperature range of ambient air: - During operation: -10 °C to +40 °C (14 °F to 104 °F) - During transport and storage: -20 °C to +55 °C (-4 °F to 131 °F)
Relative humidity: - Up to 50% at 40 °C (104 °F) - Up to 90% at 20 °C (68 °F)
Ambient air: free of dust, acids, corrosive gases or substances, etc.
Altitude above sea level: up to 2000 m (6500 ft).

Robot Interface Technical Data

Power supply	Internal (24 V)
Degree of protection	IP 23

Data transfer properties

Transfer technology: Ethernet
Medium: When selecting the cable, plug, and terminating resistors, the Powerlink assembly guideline for the planning and installation of Powerlink systems must be observed.
Transmission speed: 100 Mbit/s, half duplex mode
Bus connection: Ethernet RJ45

Configuration parameters

In some robot control systems, it may be necessary to state the configuration parameters described here so that the bus module can communicate with the robot.

Parameter	Value
Vendor-ID	$000002C1_{hex}$
Product-Code	00010341_{hex}
Manufacture Device Name	Fronius FB-Automation-1-0-Powerlink

Parameter	Value
Device Type	0000000C$_{hex}$
Manufacturer Name	Fronius International GmbH

ProfiNet IO-2P technical data

Environmental Conditions

⚠ CAUTION!

A risk is posed by prohibited environmental conditions.
This can result in severe damage to equipment.
▶ Only store and operate the device under the following environmental conditions.

Temperature range of ambient air: - During operation: -10 °C to +40 °C (14 °F to 104 °F) - During transport and storage: -20 °C to +55 °C (-4 °F to 131 °F)
Relative humidity: - Up to 50% at 40 °C (104 °F) - Up to 90% at 20 °C (68 °F)
Ambient air: free of dust, acids, corrosive gases or substances, etc.
Altitude above sea level: up to 2000 m (6500 ft).

Robot Interface Technical Data

Power supply	Internal (24 V)
Degree of protection	IP 23

Data transfer properties

Transfer technology: Ethernet
Medium: When selecting the cable, plug, and terminating resistors, the Profinet assembly guideline for the planning and installation of Profinet systems must be observed. The EMC tests were carried out by the manufacturer with the cable IEC-C5D-D4UGG0150A20A20-E.
Transmission speed: 100 Mbit/s, full duplex mode
Bus connection: Ethernet RJ45/SCRJ (fiber optic)

Configuration parameters

In some robot control systems, it may be necessary to state the configuration parameters described here so that the bus module can communicate with the robot.

Parameter	Value
Device ID	0341_{hex} (833_{dec}) Fronius ProfiNet IO 2-port

Parameter	Value
Vendor ID	$01B0_{hex}$ (432_{dec}) Fronius International GmbH
Station Type	fronius-fb-automation-1-0-pn

The following parameters provide detailed information about the bus module. The ProfiNet master can access the data using acyclic read/write services.

Parameter	Value
IM Manufacturer ID	$01B0_{hex}$ (432_{dec}) Fronius International GmbH
IM Order ID	4.044.034
IM Revision Counter	0000_{hex} (0_{dec})
IM Profile ID	$F600_{hex}$ (62976_{dec}) Generic Device
IM Profile Specific Type	0004_{hex} (4_{dec}) No profile
IM Version	0101_{hex} (257_{dec})
IM Supported	0000_{hex} (0_{dec}) IM0 supported

Modbus TCP-2P technical data

Environmental Conditions

⚠ CAUTION!

A risk is posed by prohibited environmental conditions.
This can result in severe damage to equipment.
▶ Only store and operate the device under the following environmental conditions.

Temperature range of ambient air: - During operation: -10 °C to +40 °C (14 °F to 104 °F) - During transport and storage: -20 °C to +55 °C (-4 °F to 131 °F)
Relative humidity: - Up to 50% at 40 °C (104 °F) - Up to 90% at 20 °C (68 °F)
Ambient air: free of dust, acids, corrosive gases or substances, etc.
Altitude above sea level: up to 2000 m (6500 ft).

Robot Interface Technical Data

Power supply	Internal (24 V)
Degree of protection	IP 23

Data transfer properties

RJ45 connection	
Transmission technology:	Ethernet
Medium: (4 x 2 twisted-pair copper cable)	Category 3 (10 Mbit/s) Category 5 (100 Mbit/s)
Transmission speed:	10 Mbit/s or 100 Mbit/s
Bus connection:	RJ45 Ethernet

Configuration parameters

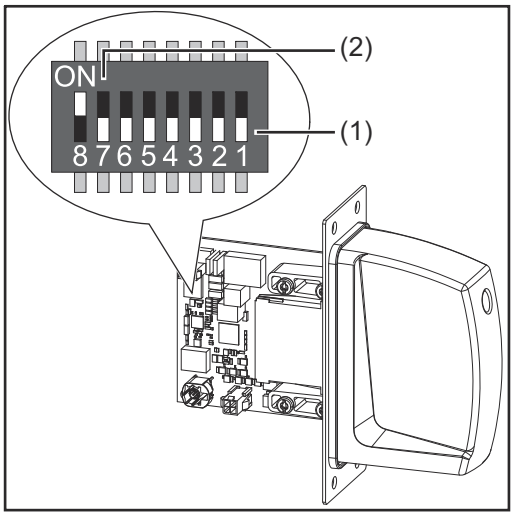
In some robot control systems, it may be necessary to state the configuration parameters described here so that the bus module can communicate with the robot.

Parameter	Value
Vendor Name	Fronius International GmbH
Product Code	0303_{hex} (771_{dec})
Vendor URL	www.fronius.com
Product Name	fronius-fb-automation-1-0-modbus-tcp
Model Name	Fronius Modbus TCP

Parameter	Value
User Application Name	Fronius welding controller for the TPS/i with Fronius Automation 1.0

Configuring the robot interface - Powerlink

General



The DIP switch on the robot interface is used to configure:
- The process image (standard image)
- The node address

Default setting for process image:
Positions 7 and 8 of DIP switch set to OFF (1) = standard image = Automation V1.0

Default setting for node address = 192.168.010.000:
- Positions 6, 5, 3, and 1 of DIP switch set to OFF (1)
- Positions 2 and 4 of DIP switch set to ON (2)

NOTE!

Whenever changes are made to the DIP switch settings, the interface must be restarted in order for the changes to take effect.

(Re-start = disconnect and reconnect the power supply
or execute the corresponding function on the power source website)

Setting the process image

Dip switch								
8	7	6	5	4	3	2	1	Configuration
OFF	OFF	-	-	-	-	-	-	Standard image (Automation V1.0)
OFF	ON	-	-	-	-	-	-	Not used
ON	OFF	-	-	-	-	-	-	Not used
ON	ON	-	-	-	-	-	-	Not used

Setting the node address with dip switch (example)

Dip switch								
8	7	6	5	4	3	2	1	Node address
-	-	OFF	OFF	OFF	OFF	OFF	ON	1
-	-	OFF	OFF	OFF	OFF	ON	OFF	2
-	-	OFF	OFF	OFF	OFF	ON	ON	3
-	-	ON	ON	ON	ON	ON	OFF	62

The node address is set with positions 1 to 6 of the dip switch.
The configuration is carried out in binary format. This results in a configuration range of 1 to 63 in decimal format.

Configure node address

Upon delivery the configured node address is 0. The node address can be configured in two ways:

- Node addresses in the range of 1 to 63 can be configured with the dip switch.
- If node address 0 is kept on the dip switch, the node addresses in the range of 1 to 63 can also be configured with the following configuration tools:
  - the website of the power source

NOTE!

If the node address is set to higher than 0 with the dip switch, the relevant node address will be configured to the range of 1 to 63 after restarting the robot interface.

A node address that has been previously configured by a configuration tool will be overwritten.

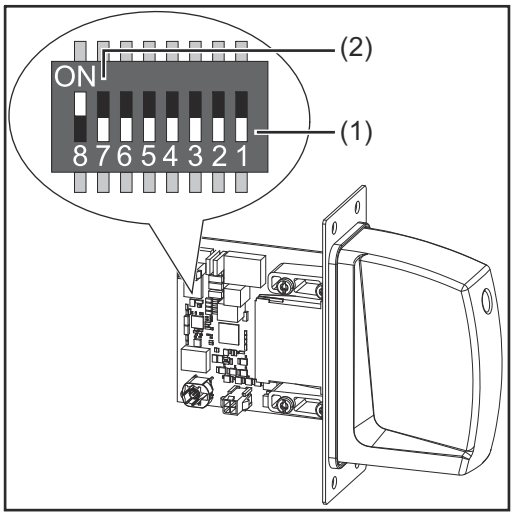
NOTE!

If configurations have already been made, the network configurations can be restored to factory settings in two ways:

▶ set all dip switches back to 0 and restart interface
or
▶ with the button Restore factory settings on the website of the power source

Configuring the robot interface - ProfiNet IO-2P

General



The DIP switch on the robot interface is used to configure:
- The process image
- The IP address

Default setting for process image:
Positions 7 and 8 of DIP switch set to OFF (1) = standard image = Automation V1.0

NOTE!

Whenever changes are made to the DIP switch settings, the interface must be restarted in order for the changes to take effect.

(Re-start = disconnect and reconnect the power supply
or execute the corresponding function on the power source website)

Setting the process image

Dip switch								
8	7	6	5	4	3	2	1	Configuration
OFF	OFF	-	-	-	-	-	-	Standard image (Automation V1.0)
OFF	ON	-	-	-	-	-	-	Not used
ON	OFF	-	-	-	-	-	-	Not used
ON	ON	-	-	-	-	-	-	Not used

The process image defines the volume of data transferred and the system compatibility.

Setting the node address with dip switch (example)

Dip switch								
8	7	6	5	4	3	2	1	Node address
-	-	OFF	OFF	OFF	OFF	OFF	ON	1
-	-	OFF	OFF	OFF	OFF	ON	OFF	2
-	-	OFF	OFF	OFF	OFF	ON	ON	3
-	-	ON	ON	ON	ON	ON	OFF	62

The node address is set with positions 1 to 6 of the dip switch.
The configuration is carried out in binary format. This results in a configuration range of 1 to 63 in decimal format.

IP Settings

Node address 0 is set via the DIP switch on delivery. This corresponds to the following IP settings:
- IP address: 0.0.0.0
- Subnet mask: 0.0.0.0
- Default gateway: 0.0.0.0

In the case of ProfiNet, the assignment of the IP address, the subnet mask, and the default gateway is carried out by the master. A device name is also assigned to the interface by the master.
As soon as the master has applied all the settings on the interface, the IP address that was set using the dip-switch is no longer valid.
The communication takes place via the IP address assigned by the master.

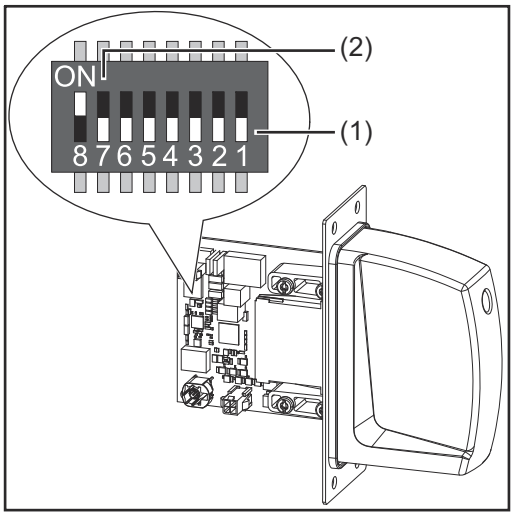
As long as the interface is not connected to a master, the IP settings can be set in the following ways:
- Using the DIP switch within the range defined by 192.168.0.xx
  (xx = DIP switch setting = 1 to 63)
- If the dip switch is set to 0, using the following configuration tools:
  - Using the website of the power source

NOTE!

If configurations have already been made, the network configurations can be restored to factory settings in two ways:
▶ set all dip switches back to 0 and restart interface
  or
▶ with the button **Restore factory settings** on the website of the power source

Configuring the robot interface - Modbus TCP-2P

General



The DIP switch on the robot interface is used to configure:
- The process image (standard image)
- The IP address

Default setting for process image:
Positions 7 and 8 of DIP switch set to OFF (1) = standard image = Automation V1.0

Default setting for IP address = 192.168.255.200:
- Positions 6, 5, 3, and 1 of DIP switch set to OFF (1)
- Positions 2 and 4 of DIP switch set to ON (2)

NOTE!

Whenever changes are made to the DIP switch settings, the interface must be restarted in order for the changes to take effect.

(Re-start = disconnect and reconnect the power supply
or execute the corresponding function on the power source website)

Setting the process image

Dip switch								
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**Configuration**
OFF	OFF	-	-	-	-	-	-	Standard image (Weldcom V2.0)
OFF	ON	-	-	-	-	-	-	Not used
ON	OFF	-	-	-	-	-	-	Retrofit image (Weldcom TPS series)
ON	ON	-	-	-	-	-	-	Not used

The process image defines the volume of data transferred and the system compatibility.

Setting the IP address

You can set the IP address as follows:
- Via the DIP switches within the range defined by 192.168.255.200 (xx = DIP switch setting = 01 to 55)

Dip switch								
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**IP address**
-	-	OFF	OFF	OFF	OFF	OFF	ON	192.168.255.**201**

Dip switch								
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**IP address**
-	-	OFF	OFF	OFF	OFF	ON	OFF	192.168.255.**202**
								:
-	-	ON	ON	OFF	ON	ON	OFF	192.168.255.**254**
-	-	ON	ON	OFF	ON	ON	ON	192.168.255.**255**

The IP address can be set via positions 1 to 6 of the DIP switch.
The configuration is carried out in binary format. In decimal format, the setting range is 01 through 55.

Installing the Robot Interface

Safety

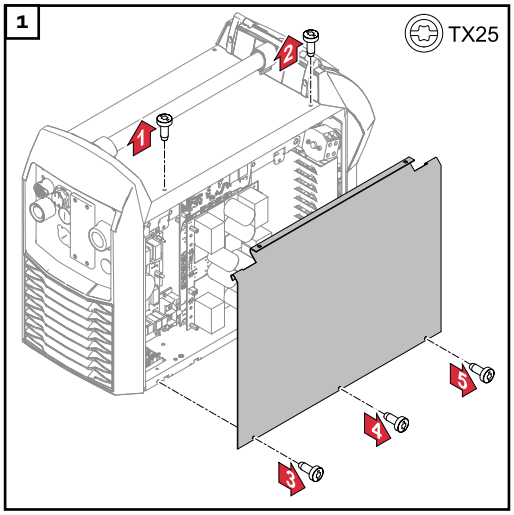
⚠ WARNING!

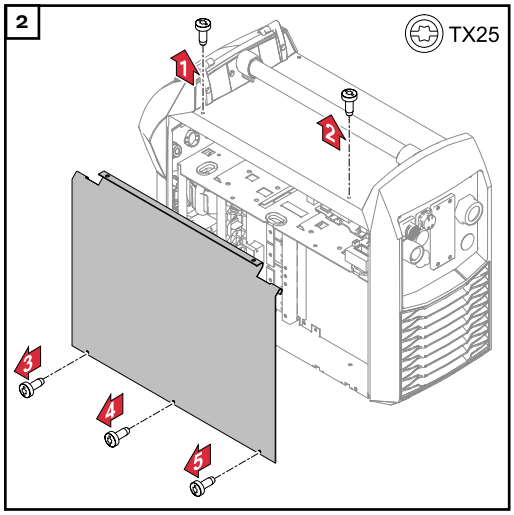
Electrical current hazard.
This can result in serious injuries or death.
- ▶ Before starting work, switch off all the devices and components involved and disconnect them from the grid.
- ▶ Secure all the devices and components involved to prevent unintentional re-starting.
- ▶ After opening the device, use a suitable measuring instrument to check that electrically charged components (such as capacitors) have been discharged.

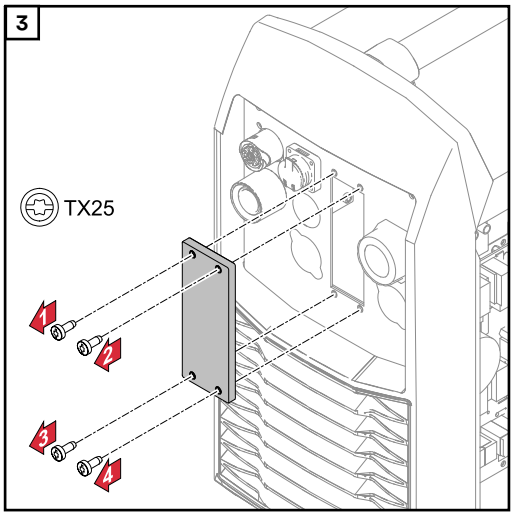
⚠ WARNING!

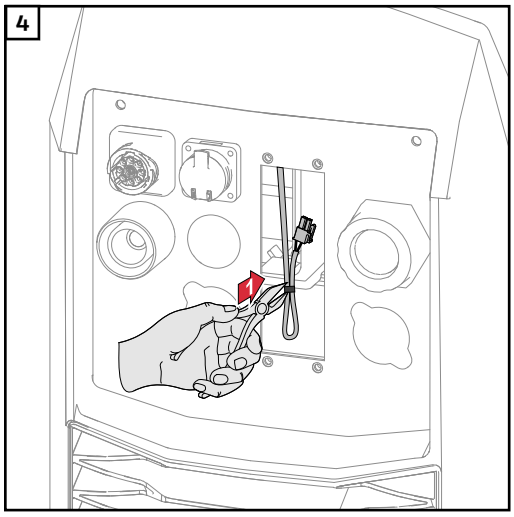
Electrical current hazard caused by an inadequate ground conductor connection.
This can result in severe personal injury and damage to property.
- ▶ Always use the original housing screws in the original quantity.

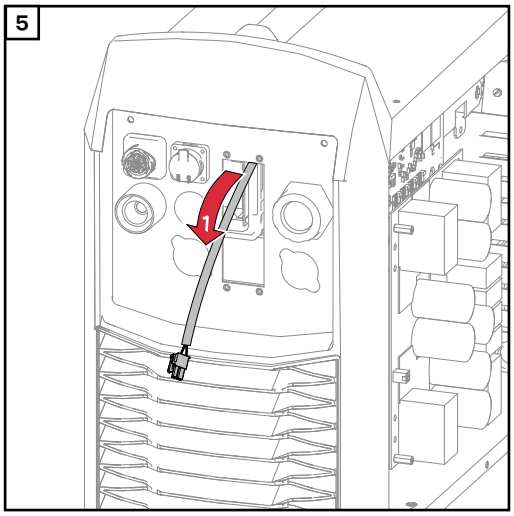
Preparation



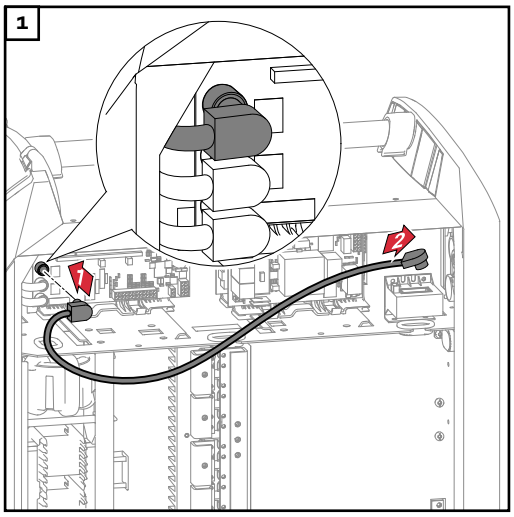


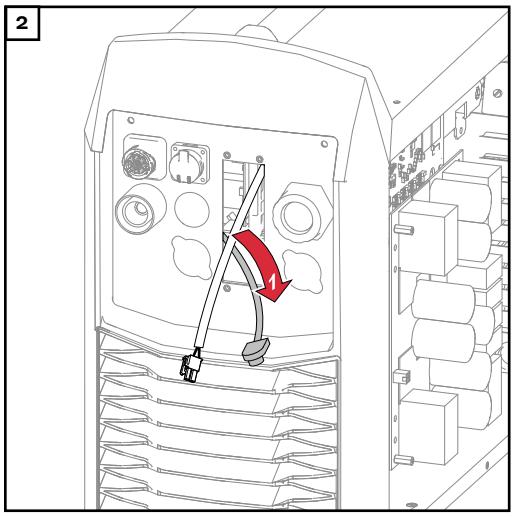


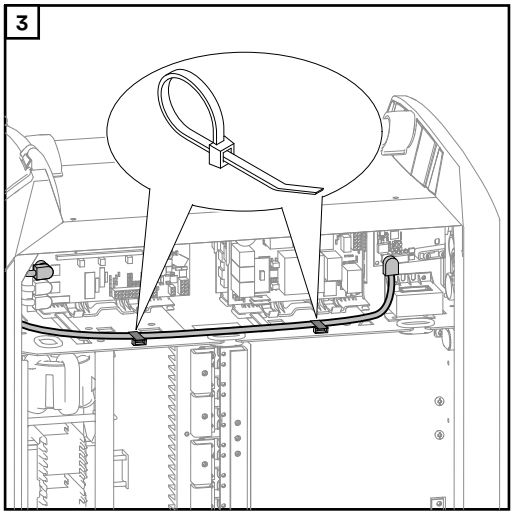




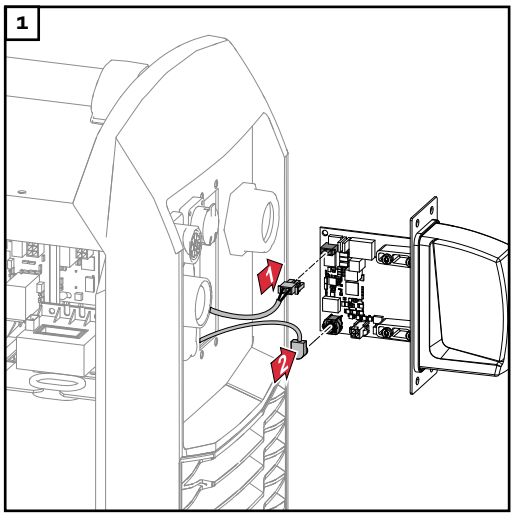
Routing the Data Cable

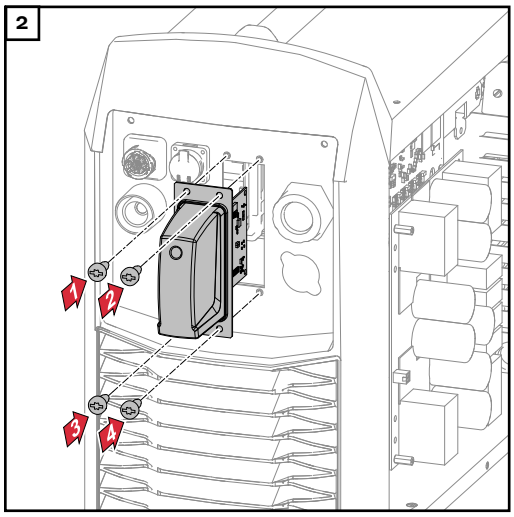




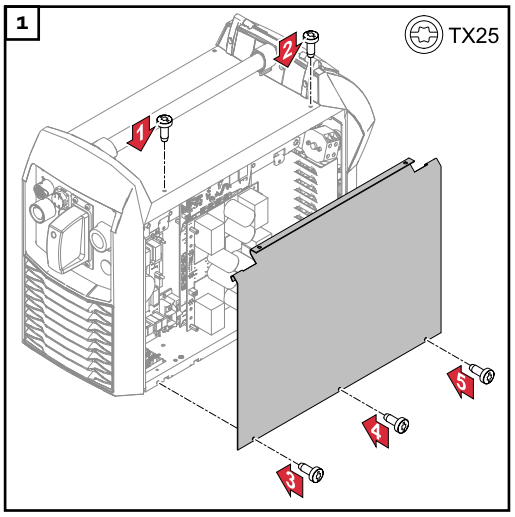


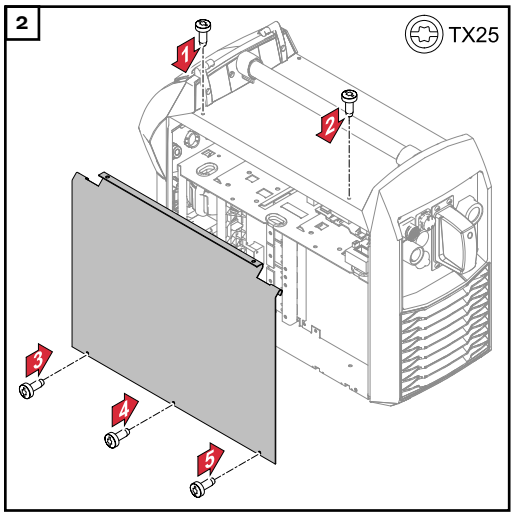
Installing the Robot Interface





Final Tasks





Installing the Bus Module

Safety

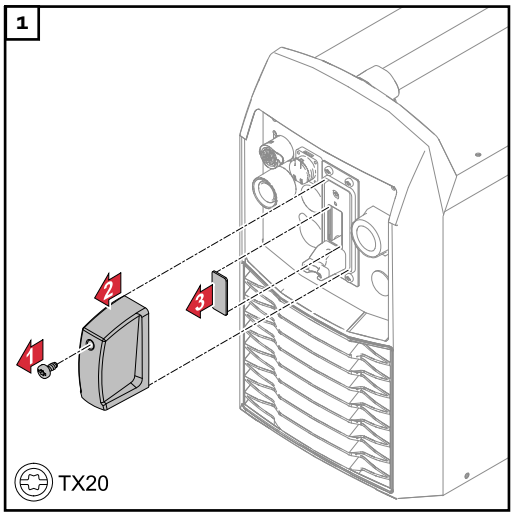
⚠ WARNING!

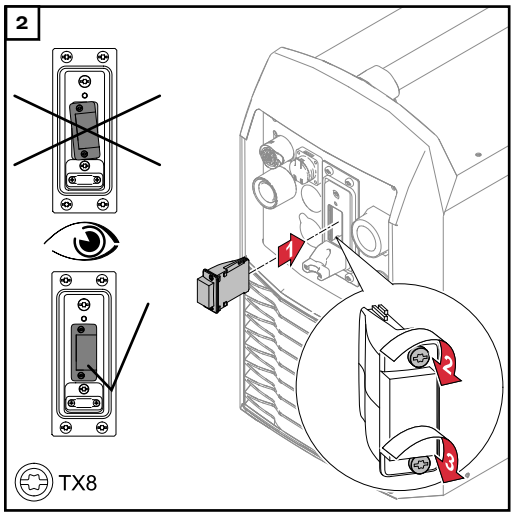
Danger from electrical current.
Serious injuries or death may result.
- ▶ Before starting work, switch off all devices and components involved, and disconnect them from the grid.
- ▶ Secure all devices and components involved so that they cannot be switched back on.

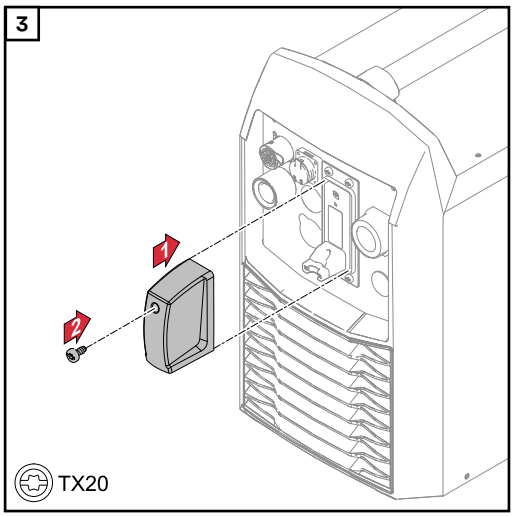
⚠ WARNING!

Danger from electrical current due to inadequate ground conductor connection.
Serious personal injury and property damage may result.
- ▶ Always use the original housing screws in the quantity initially supplied.

Installing the Bus Module







Input and output signals - standard image Automation V1.0

Data types

The following data types are used:
- **UINT16** (Unsigned Integer)
  Whole number in the range from 0 to 65535
- **SINT16** (Signed Integer)
  Whole number in the range from -32768 to 32767

Conversion examples:
- for a positive value (SINT16)
  e.g. desired wire speed x factor
  12.3 m/min x 100 = 1230_{dec} = $04CE_{hex}$

- for a negative value (SINT16)
  e.g. arc correction x factor
  -6.4 x 10 = -64_{dec} = $FFC0_{hex}$

Availability of input signals

The input signals listed below are available from firmware V3.2.30 of the TPS/i power source.

Input signals (from robot to power source)

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
0	0	0	0	Welding Start	Increas-ing		
		1	1	Robot ready	High		
		2	2	Working mode Bit 0	High	See table **Value range for Working mode** on page **39**	
		3	3	Working mode Bit 1	High		
		4	4	Working mode Bit 2	High		
		5	5	Working mode Bit 3	High		
		6	6	Working mode Bit 4	High		
		7	7	—			
	1	0	8	Gas on	Increas-ing		
		1	9	Wire forward	Increas-ing		
		2	10	Wire backward	Increas-ing		
		3	11	Error quit	Increas-ing		
		4	12	Touch sensing	High		
		5	13	Torch blow out	Increas-ing		
		6	14	Processline selection Bit 0	High		
		7	15	Processline selection Bit 1	High		

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
1	2	0	16	Welding simulation	High		
		1	17	Synchro pulse on	High		
		2	18	SFI on	High		
		3	19	—			
		4	20	—			
		5	21	Booster manual	High		
		6	22	Wire brake on	High		
		7	23	Torchbody Xchange	High		
	3	0	24	—			
		1	25	Teach mode	High		
		2	26	Valve on	High		
		3	27	—			
		4	28	—			
		5	29	Wire sense start	Increas-ing		
		6	30	Wire sense break	Increas-ing		
		7	31	—			
2	4	0	32	TWIN mode bit 0	High	See table **Value Range for TWIN Mode** on page **40**	
		1	33	TWIN mode bit 1	High		
		2	34	—			
		3	35	—			
		4	36	—			
		5	37	Documentation mode	High	See table **Value range for Documentation mode** on page **40**	
		6	38	—			
		7	39	—			
	5	0	40	—			
		1	41	—			
		2	42	—			
		3	43	—			
		4	44	—			
		5	45	—			
		6	46	—			
		7	47	—			

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
3	6	0	48	—			
		1	49	—			
		2	50	—			
		3	51	—			
		4	52	—			
		5	53	—			
		6	54	—			
		7	55	—			
	7	0	56	ExtInput1 => OPT_Output 1	High		
		1	57	ExtInput2 => OPT_Output 2	High		
		2	58	ExtInput3 => OPT_Output 3	High		
		3	59	ExtInput4 => OPT_Output 4	High		
		4	60	ExtInput5 => OPT_Output 5	High		
		5	61	ExtInput6 => OPT_Output 6	High		
		6	62	ExtInput7 => OPT_Output 7	High		
		7	63	ExtInput8 => OPT_Output 8	High		
4	8	0–7	64–71	Welding characteristic- / Job number	UINT16	0 to 65535	1
	9	0–7	72–79				
5	10, 11	0–7	80–95	*For the welding processes MIG/MAG pulse synergic, MIG/MAG standard synergic, MIG/MAG standard manual, MIG/MAG PMC, MIG/MAG LSC, CMT, ConstantWire:* **Wire feed speed command value**	SINT16	-327.68 to 327.67 [m/min]	100
				For job mode: **Power correction**	SINT16	-20.00 to 20.00 [%]	100

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
6	12, 13	0–7	96–111	*For the welding processes MIG/MAG pulse synergic, MIG/MAG standard synergic, MIG/MAG PMC, MIG/MAG LSC, CMT:* **Arclength correction**	SINT16	-10.0 to 10.0 [steps]	10
				For the welding process MIG/MAG standard manual: **Welding voltage**	UINT16	0.0 to 6553.5 [V]	10
				For job mode: **Arclength correction**	SINT16	-10.0 to 10.0 [steps]	10
				For the welding process ConstantWire: **Hotwire current**	UINT16	0.0 to 6553.5 [A]	10
7	14, 15	0–7	112–127	*For the welding processes MIG/MAG pulse synergic, MIG/MAG standard synergic, MIG/MAG PMC, MIG/MAG LSC, CMT:* **Pulse-/dynamic correction**	SINT16	-10.0 to 10.0 [steps]	10
				For the welding process MIG/MAG standard manual: **Dynamic**	UINT16	0.0 to 10.0 [steps]	10
8	16	0–7	128–135	Wire retract correction	UINT16	0.0 to 10.0	10
	17	0–7	136–143				
9	18	0–7	144–151	Welding speed	UINT 16	0 to 6553.5 [cm/min]	10
	19	0–7	152–159				
10	20	0–7	160–167	—			
	21	0–7	168–175				
11	22	0–7	176–183	—			
	23	0–7	184–191				
12	24	0–7	192–199	—			
	25	0–7	200–207				
13	26	0–7	208–215	—			
	27	0–7	216–223				

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
14	28	0–7	224–231	—			
	29	0–7	232–239				
15	30	0–7	240–247	Wire forward / backward length	UINT16	OFF / 1 to 65535[mm]	1
	31	0–7	248–255				
16	32	0–7	256–263	Wire sense edge detection	UINT16	OFF / 0.5 to 20 [mm]	10
	33	0–7	264–271				
17	34	0–7	272–279	—			
	35	0–7	280–287				
18	36	0–7	288–295	—			
	37	0–7	296–303				
19	38	0–7	304–311	Seam number	UINT16	0 to 65535	1
	39	0–7	312–319				
20	40	0	320	Disable Start-End-Parameter	High		
		1	321	Disable SFI-Parameter	High		
		2	322	Disable SP-Parameter	High		
		3	323	Disable Process-Mix-Parameter	High		
		4	324	Disable gas-settings	High		
		5	325	Disable components setup (TAG)	High		
		6	326	Disable Language/Units/Standards (TAG)	High		
		7	327	Disable Penetration/Arclength-stabilizer	High		
	41	0	328	Disable CMT cycle step parameter	High		
		1	329	—			
		2	330	—			
		3	331	—			
		4	332	Contact tip short circuit detection	High		
		5	333	Pulse synchronization ratio Bit 0	High		
		6	334	Pulse synchronization ratio Bit 1	High		
		7	335	CMT cycle step	High		

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
21	42	0	336	Command value selection Bit 0	High		
		1	337	—			
		2	338	Enable resistance overwrite	High		
		3	339	Set resistance value	High		
		4	340	Enable inductance overwrite	High		
		5	341	Set inductance value	High		
		6	342	—			
		7	343	—			
	43	0	344–351	—			
22	44	0–7	352–359	TAG Address 1	UINT 16	0 to 65535	1
	45	0–7	360–367				
23	46	0–7	368–375	TAG Value 1	UINT 16	0 to 65535	1
	47	0–7	376–383				
24	48	0–7	384–391	TAG Command 1	UINT 8	1 to 2	1
	49	0–7	392–399	—			
25	50	0–7	400–407	TAG Address 2	UINT 16	0 to 65535	1
	51	0–7	408–415				
26	52	0–7	416–423	TAG Value 2	UINT 16	0 to 65535	1
	53	0–7	424–431				
27	54	0–7	432–439	TAG Command 2	UINT 8	1 to 2	1
	55	0–7	440–447	—			
28	56	0–7	448–455	Command value gas	UINT 16	5 to 30 [l/min]	10
	57	0–7	456–463				
29	58	0–7	464–471	S2T-Starting current	UINT 16	0 to 200 [%]	1
	59	0–7	472–479				
30	60	0–7	480–487	S2T-Starting current time	UINT 16	Off (0.0)/ 0.1 to 10.0 [s]	10
	61	0–7	488–495				
31	62	0–7	496–503	S2T End current	UINT 16	0 to 200 [%]	1
	63	0–7	504–511				
32	64	0–7	512–519	S2T End current time	UINT 16	Off (0.0)/ 0.1 to 10.0 [s]	10
	65	0–7	520–527				
33	66	0–7	528–535	PM High power time corr.	SINT 16	-10 to +10	10
	67	0–7	536–543				
34	68	0–7	544–551	PM Low power time corr.	SINT 16	-10 to +10	10
	69	0–7	552–559				

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
35	70	0–7	560–567	PM Low power corr.	SINT 16	-10 to +10	10
	71	0–7	568–575				
36	72	0–7	576–583	CMT Cycle Step - Cycles (Spot size)	SINT 16	1 to 2000	1
	73	0–7	584–591				
37	74	0–7	592–599	CMT Cycle Step - Interval break time	SINT 16	0.01 to 2.00 [s]	1
	75	0–7	600–607				
38	76	0–7	608–615	CMT Cycle Step - Interval cycles	SINT 16	Permanent/1 to 2000	1
	77	0–7	616–623				
39	78	0–7	624–631	Spot welding time	SINT 16	0.1 to 10 [s]	10
	79	0–7	632–639				
40	80	0–7	640–647	Penetration stabilizer	SINT 16	0.0 to 5	10
	81	0–7	648–655				
41	82	0–7	656–663	Arc length stabilizer	SINT 16	0.0 to 5	10
	83	0–7	664–671				
42	84	0–7	672–679	Phase shift Lead / Trail	UINT 8	Auto/0 to 95 [s]	1
	85	0–7	680–687	Ignition delay Trail	UINT 8	Auto/Off/0.00 to 2.00 [s]	100
43	86	0–7	688–695	—			
	87	0–7	696–703				
44	88	0–7	704–711	—			
	89	0–7	712–719				
45	90	0–7	720–727	—			
	91	0–7	728–735				
46	92	0–7	736–743	Resistance	UINT 16	0 to +400 [mOhm]	10
	93	0–7	744–751				
47	94	0–7	752–759	Inductance	UINT 16	0 to +250 [microhenries]	10
	95	0–7	760–767				

Value range for Working mode

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	Internal welding parameter selection
0	0	0	0	1	Special 2-step mode characteristics
0	0	0	1	0	Job mode
0	1	0	0	0	2-step mode characteristics

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	1	0	0	1	MIG/MAG standard manual
1	0	0	0	0	Disable Booster
1	1	0	0	0	R/L measurement
1	1	0	0	1	R/L alignment

Value range for operating mode

Value Range for TWIN Mode

Bit 1	Bit 0	Description
0	0	TWIN Single mode
0	1	TWIN Lead mode
1	0	TWIN Trail mode
1	1	Reserved

Value range for TWIN mode

Value range for Documentation mode

Bit 0	Documentation generator
0	Power source
1	Robot (Word 19)

Value range for documentation mode

Availability of the output signals

The output signals listed below are available from firmware V3.2.30 of the TPS/i power source.

Output signals (from power source to robot)

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
0	0	0	0	Heartbeat Powersource	High / Low		
		1	1	Power source ready	High		
		2	2	Warning	High		
		3	3	Process active	High		
		4	4	Current flow	High		
		5	5	Arc stable- / touch signal	High		
		6	6	Main current signal	High		
		7	7	Touch signal	High		
	1	0	8	Collisionbox active	Low	0 = collision or cable break	
		1	9	Robot Motion Release	High		
		2	10	Wire stick workpiece	High		
		3	11	—			
		4	12	Short circuit contact tip	High		
		5	13	Parameter selection internally	High		
		6	14	Characteristic number valid	High		
		7	15	Torch body gripped	High		

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
1	2	0	16	Command value out of range	High		
		1	17	Correction out of range	High		
		2	18	—			
		3	19	Limit Signal	High		
		4	20	—			
		5	21	Standby active	High		
		6	22	Main supply status	Low		
		7	23	—			
	3	0	24	Sensor status 1	High	See table **Assignment of Sensor Statuses 1–4** on page **46**	
		1	25	Sensor status 2	High		
		2	26	Sensor status 3	High		
		3	27	Sensor status 4	High		
		4	28	—			
		5	29	—			
		6	30	—			
		7	31	—			
2	4	0	32	Function status Bit 0	High	See table **Value range for Function status** on page **46**	
		1	33	Function status Bit 1	High		
		2	34	—			
		3	35	Safety status Bit 0	High	See table **Value range Safety status** on page **46**	
		4	36	Safety status Bit 1	High		
		5	37	—			
		6	38	Notification	High		
		7	39	System not ready	High		
	5	0	40	—			
		1	41	—			
		2	42	—			
		3	43	—			
		4	44	—			
		5	45	—			
		6	46	—			
		7	47	—			

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
3	6	0	48	Process Bit 0	High	See table **Value Range for Process Bit** on page **46**	
		1	49	Process Bit 1	High		
		2	50	Process Bit 2	High		
		3	51	Process Bit 3	High		
		4	52	Process Bit 4	High		
		5	53	—			
		6	54	Gas nozzle touched	High		
		7	55	TWIN synchronisation active	High		
	7	0	56	ExtOutput1 <= OPT_Input1	High		
		1	57	ExtOutput2 <= OPT_Input2	High		
		2	58	ExtOutput3 <= OPT_Input3	High		
		3	59	ExtOutput4 <= OPT_Input4	High		
		4	60	ExtOutput5 <= OPT_Input5	High		
		5	61	ExtOutput6 <= OPT_Input6	High		
		6	62	ExtOutput7 <= OPT_Input7	High		
		7	63	ExtOutput8 <= OPT_Input8	High		
4	8	0–7	64–71	Welding voltage	UINT16	0.0 to 327.67 [V]	100
	9	0–7	72–79				
5	10	0–7	80–87	Welding current	UINT16	0.0 to 327.67 [A]	10
	11	0–7	88–95				
6	12	0–7	96–103	Wire feed speed	SINT16	-327.68 to 327.67 [m/min]	100
	13	0–7	104–111				
7	14	0–7	112–119	Actual real value for seam tracking	UINT16	0 to 65535	10000
	15	0–7	120–127				
8	16	0–7	128–135	Error number	UINT16	0 to 65535	1
	17	0–7	136–143				
9	18	0–7	144–151	Warning number	UINT16	0 to 65535	1
	19	0–7	152–159				
10	20	0–7	160–167	Motor current M1	SINT16	-327.68 to 327.67 [A]	100
	21	0–7	168–175				
11	22	0–7	176–183	Motor current M2	SINT16	-327.68 to 327.67 [A]	100
	23	0–7	184–191				
12	24	0–7	192–199	Motor current M3	SINT16	-327.68 to 327.67 [A]	100
	25	0–7	200–207				
13	26	0–7	208–215	—			
	27	0–7	216–223				

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
14	28	0–7	224–231	—			
	29	0–7	232–239				
15	30	0–7	240–247	—			
	31	0–7	248–255				
16	32	0–7	256–263	Wire position	SINT16	-327.68 to 327.67 [mm]	100
	33	0–7	264–271				
17	34	0–7	272–279	—			
	35	0–7	280–287				
18	36	0–7	288–295	—			
	37	0–7	296–303				
19	38	0–7	304–311	—			
	39	0–7	312–319				
20	40	0	320–327	—			
	41	0	328–335				
21	42	0–7	336–343	—			
	43	0–7	344–351				
22	44	0–7	352–359	TAG Address 1	UINT16		1
	45	0–7	360–367				
23	46	0–7	368–375	TAG Value 1	UINT16		1
	47	0–7	376–383				
24	48	0–7	384–391	TAG Command 1	UINT8	1 to 2	1
	49	0–7	392–399	—			
25	50	0–7	400–407	TAG Address 2	UINT16		1
	51	0–7	408–415				
26	52	0–7	416–423	TAG Value 2	UINT16		1
	53	0–7	424–431				
27	54	0–7	432–439	TAG Command 2	UINT8	1 to 2	1
	55	0–7	440–447	—			
28	56	0–7	448–455	Cooler temperature	SINT16	-100.00 to +100.00 [°C]	10
	57	0–7	456–463				
29	58	0–7	464–471	Cooler flow rate	SINT16	-100.00 to +100.00 [l/min]	100
	59	0–7	472–479				
30	60	0–7	480–487	Real energy actual value	UINT16	0 to 6553.5 [kJ]	10
	61	0–7	488–495				
31	62	0–7	496–503	Power actual value	UINT16	0 to 6553.5 [kW]	100
	63	0–7	504–511				

Address				Signal	Activity/ data type	Range	Factor
Relative			Absolute				
WORD	BYTE	BIT	BIT				
32	64	0–7	512–519	Gas real rate	UINT16	0.0 to +100.0 [l/min]	10
	65	0–7	520–527				
33	66	0–7	528–535	Resistance	UINT 16	0.0 to +400 [mOhm]	10
	67	0–7	536–543				
34	68	0–7	544–551	Inductance	UINT 16	0.0 to +250 [microhenries]	10
	69	0–7	552–559				
35	70	0–7	560–567	Real value - Welding voltage	UINT16	0.0 to 327.67 [V]	100
	71	0–7	568–575				
36	72	0–7	576–583	Real value - Welding current	UINT16	0.0 to 3276.7 [A]	10
	73	0–7	584–591				
37	74	0–7	592–599	Real value - Wire feed speed	UINT16	-327.68 to +327.67 [m/min]	10
	75	0–7	600–607				
38	76	0–7	608–615	—			
	77	0–7	616–623				
39	78	0–7	624–631	—			
	79	0–7	632–639				
40	80	0–7	640–647	—			
	81	0–7	648–655				
41	82	0–7	656–663	—			
	83	0–7	664–671				
42	84	0–7	672–679	—			
	85	0–7	680–687				
43	86	0–7	688–695	—			
	87	0–7	696–703				
44	88	0–7	704–711	—			
	89	0–7	712–719				
45	90	0–7	720–727	—			
	91	0–7	728–735				
46	92	0–7	736–743	—			
	93	0–7	744–751				
47	94	0–7	752–759	—			
	95	0–7	760–767				

Assignment of Sensor Statuses 1–4

Signal	Description
Sensor status 1	OPT/i WF R wire end (4,100,869)
Sensor status 2	OPT/i WF R wire drum (4,100,879)
Sensor status 3	OPT/i WF R ring sensor (4,100,878)
Sensor status 4	Wire buffer set CMT TPS/i (4,001,763)

Value range for Function status

Bit 1	Bit 0	Description
0	0	inactive
0	1	idle
1	0	finished
1	1	Error

Value range for function status

Value range Safety status

Bit 1	Bit 0	Description
0	0	Reserve
0	1	Hold
1	0	Stop
1	1	Not installed / active

Value Range for Process Bit

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	No internal parameter selection or process
0	0	0	0	1	MIG/MAG pulse synergic
0	0	0	1	0	MIG/MAG standard synergic
0	0	0	1	1	MIG/MAG PMC
0	0	1	0	0	MIG/MAG LSC
0	0	1	0	1	MIG/MAG standard manual
0	0	1	1	0	Electrode
0	0	1	1	1	TIG
0	1	0	0	0	CMT
0	1	0	0	1	ConstantWire

TAG Table

TAG number	Description	Reading/writing	Range	Unit	Factor
1	Cooling unit mode	Reading & writing	See **Value range for TAG number 1 (Cooling unit mode)** on page **49**	-	1
2	Delay time flow sensor	Reading & writing	5 to 25	s	1
3	Touch sensing sensitivity	Reading & writing	0 to 10	-	1
4	Ignition timeout	Reading & writing	less than 5 = off; 5 to 100	mm	1
10	Arc break monitoring	Reading & writing	See **Value range for TAG number 11 (Arc break monitoring)** on page **49**	-	1
11	Arc break monitoring	Reading & writing	0 to 2.00	s	100
15	Wire stick contact tip	Reading & writing	1/2 1 = ignore 2 = error	-	1
16	Wire stick filter time	Reading & writing	0.5 to 5.0	s	10
20	Wire stick workpiece	Reading & writing	1/2 1 = ignore 2 = error	-	1
25	Wire end ring sensor	Reading & writing	1/2/3 1 = ignore 2 = after seam end 3 = error	-	1
26	Wire end drum sensor	Reading & writing	1/2/3 1 = ignore 2 = after seam end 3 = error	-	1
27	Wire end wirespool	Reading & writing	1/2/3 1 = ignore 2 = after seam end 3 = error	-	1
30	Lower gasflow limit	Reading & writing	0.5 to 30.0	l/min	10

TAG number	Description	Reading/writing	Range	Unit	Factor
31	Maximum time of gas deviation	Reading & writing	0.1 to 10.0	s	10
32	Sensor gas factor	Reading & writing	less than 0.90 = auto; 0.90 to 20.00	-	100
35	Language	Reading & writing	See **Value range for TAG number 35 (Language)** on page **49**	-	
36	Unit (metric/imperial)	Reading & writing	See **Value range for TAG number 36 (Unit - metric/ imperial)** on page **50**	-	
37	Welding standard (AWS/EU)	Reading & writing	See **Value range for TAG number 37 (Welding standard - AWS/EU)** on page **50**	-	
40	DHCP	Reading & writing	1/2 1 = off 2 = on	-	1
105	Gas preflow	Reading & writing	0 to 9.9	s	10
106	Gas postflow	Reading & writing	0 to 60.0	s	10
107	Gas factor	Reading & writing	auto/ 0.90 to 20.00	-	100
110	S2T - Slope 1	Reading & writing	0 to 9.9	s	10
111	S2T - Slope 2	Reading & writing	0 to 9.9	s	10
112	Start Arclength correction	Reading & writing	-10.0 to +10.0	-	10
113	End Arclength correction	Reading & writing	-10.0 to +10.0	-	10
114	SFI Hotstart	Reading & writing	less than 0.01 = off; 0.01 to 2.00	-	100
120	SP Delta wire feed	Reading & writing	0.1 to 6.0	m/min	10
121	SP Frequency	Reading & writing	0.5 to 10.0	Hz	10
122	SP Dutycycle	Reading & writing	10 to 90	%	1
123	SP Arc length correction high	Reading & writing	-10.0 to +10.0	-	10
124	SP Arc length correction low	Reading & writing	-10.0 to +10.0	-	10
130	Inching value	Reading & writing	0.5 to 25.0 (vD-max Processline)	m/min	100
205	Hour meter power on [0]	Read only	0 to 100000	h	1
206	Hour meter power on [1]	Read only	0 to 100000	h	1

TAG number	Description	Reading/writing	Range	Unit	Factor
210	Hour meter arc on time [0]	Read only	0 to 100000	h	1
211	Hour meter arc on time [1]	Read only	0 to 100000	h	1
215	Wire speed minimum	Read only	0 to 100.0	m/min	10
216	Wire speed maximum	Read only	0 to 100.0	m/min	10

Value range for TAG number 1 (Cooling unit mode)

Value	Description
0	-
1	eco
2	auto
3	on
4	off

Value range for TAG number 11 (Arc break monitoring)

Value	Description
0	-
1	Ignore
2	Error

Value range for TAG number 35 (Language)

Value	Description
1	English
2	German
3	Japanese
4	Chinese
5	Spanish
6	French
7	Czech
8	Hungarian
9	Italian
10	Norwegian
11	Polish
12	Portuguese
13	Slovakian
14	Turkish
15	Russian
16	Swedish

Value	Description
17	Estonian
18	Finnish
19	Lithuanian
20	Latvian
21	Dutch
22	Slovenian
23	Romanian
24	Croatian
25	Ukrainian
26	Korean
27	Icelandic
28	Vietnamese
29	Thai
30	Indonesian
31	Serbian
32	Hindi
33	Tamil
34	Danish
35	Bulgarian

Value range for TAG number 36 (Unit - metric/ imperial)

Value	Description
0	-
1	Imperial
2	Metric

Value range for TAG number 37 (Welding standard - AWS/EU)

Value	Description
0	-
1	AWS
2	EN

Input and output signals Weldcom V2.0

Data types

The following data types are used:
- **UINT16** (Unsigned Integer)
  Whole number in the range from 0 to 65535
- **SINT16** (Signed Integer)
  Whole number in the range from -32768 to 32767

Conversion examples:
- for a positive value (SINT16)
  e.g. desired wire speed x factor
  12.3 m/min x 100 = 1230_{dec} = $04CE_{hex}$

- for a negative value (SINT16)
  e.g. arc correction x factor
  -6.4 x 10 = -64_{dec} = $FFC0_{hex}$

Input Signals

From robot to power source
Applicable to firmware V3.5.0 and higher

HEX address	Signal		Type	Unit/Area	Factor
F000	Control Flag Group 1				
	Bits 0 to 7	Process active timeout	Byte	ms	10
	Bits 8–15	Reserved			
F001	Control Flag Group 2				
	Bit 0	Welding start	Boolean		
	Bit 1	Robot ready	Boolean		
	Bit 2	Source error reset	Boolean		
	Bit 3	Gas on	Boolean		
	Bit 4	Wire inching	Boolean		
	Bit 5	Wire retract	Boolean		
	Bit 6	Torch blow out	Boolean		
	Bit 7	Welding simulation	Boolean		
	Bit 8	Touch sensing	Boolean		
	Bit 9	Booster manual	Boolean		
	Bit 10	SFI ON	Boolean		
	Bit 11	Synchro pulse on	Boolean		
	Bit 12	WireBrake	Boolean		
	Bit 13	Torch XChange	Boolean		
	Bit 14	Teach mode	Boolean		
	Bit 15	Reserved			

HEX address	Signal		Type	Unit/Area	Factor
F002	Control Flag Group 3				
	Bit 0	Process line selection Bit 0	Boolean	See **Value range Process line selection** on page **54**	
	Bit 1	Process line selection Bit 1	Boolean		
	Bit 2	TWIN mode Bit 0	Boolean	See **Value Range for TWIN Mode** on page **54**	
	Bit 3	TWIN mode Bit 1	Boolean		
	Bits 4 to 9	Reserved			
	Bit 10	Active heat control	Boolean		
	Bit 11	Wire sense start	Boolean		
	Bit 12	Wire sense break	Boolean		
	Bits 13 to 15	Reserved	Boolean		
F003	Control Flag Group 4				
	Bit 0	Documentation mode	Boolean	See **Value Range for Documentation mode** on page **55**	
	Bits 1–15	Reserved			
F004	Control Flag Group 5				
	Bits 0–15	Reserved			
F005	Control Flag Group 6				
	Bits 0–15	Reserved			
F006	Control Flag Group 7				
	Bit 0	CMT Cycle Step on	Boolean		
	Bits 1–7	Reserved			
	Bit 8	Enable CMT Cycle Step	Boolean		
	Bit 9	Enable PMC Mix	Boolean		
	Bit 10	Disable Start-End-Parameter	Boolean		

HEX address	Signal		Type	Unit/Area	Factor
F007	Control Flag Group 8				
	Bit 0	ExtInput1 => OPT_Output 1	Boolean		
	Bit 1	ExtInput2 => OPT_Output 2	Boolean		
	Bit 2	ExtInput3 => OPT_Output 3	Boolean		
	Bit 3	ExtInput4 => OPT_Output 4	Boolean		
	Bit 4	ExtInput5 => OPT_Output 5	Boolean		
	Bit 5	ExtInput6 => OPT_Output 6	Boolean		
	Bit 6	ExtInput7 => OPT_Output 7	Boolean		
	Bit 7	ExtInput8 => OPT_Output 8	Boolean		
	Bits 8–15	Reserved			
F008	Working mode				
	Bit 0	Working Mode Bit 0		See **Value range for Working mode** on page **55**	
	Bit 1	Working Mode Bit 1			
	Bit 2	Working Mode Bit 2			
	Bit 3	Working Mode Bit 3			
	Bit 4	Working Mode Bit 4			
	Bits 5–13	Reserved			
	Bit 14	Command value selection	Boolean	See **Value Range for Command value selection** on page **55**	
	Bit 15	Reserved			
F009	Job number		UINT16	0 to 1000	
F00A	Program number (xml-file)		UINT16	0 to 65535	
F00B	Feeder command value		SINT16	-327.68 to 327.67 m/min	100
F00C	Arc length correction		SINT16	-10 to +10	10
F00D	Puls/Dynamik correction		SINT16	-10 to +10	10
F00E	Wire retract		SINT16	0 to +10	10
F00F	Welding speed		UINT16	0 to 65535 (0 to 6553.5 m/min)	10
F010	Penetration stabilizer		SINT16	0 to +10	10
F011	Arc length stabilizer		UINT16	0 to +10	10
F012	Reserved				
F013	Reserved				
F014	Reserved				
F015	Reserved				
F016	Reserved				

HEX address	Signal	Type	Unit/Area	Factor
F017	Reserved			
F018	Reserved			
F019	Reserved			
F01A	Wire forward / backward length	UINT16	OFF/1 to 65535 mm	1
F01B	Wire sense edge detection	UINT16	OFF/0.5 to 20.0 mm	10
F01C	Reserved			
F01D	Seam number	UINT16	0 to 65535	1
F01E	Process-Mix High power time correction	SINT16	-10 to 10	10
F01F	Process-Mix Low power time correction	SINT16	-10 to 10	10
F020	Low power time correction CMT	SINT16	1 to 100	1
F021	Process-Mix Low power correction	SINT16	-10 to 10	10
F022	CMT Cycle Step Cycles (Spot size)	SINT16	0 to 2000	1
F023	CMT Cycle Step Interval break time	SINT16	0.01 to 2.00	100
F024	CMT Cycle Step Interval cycles	SINT16	Permanent (=0)/1 to 2000	1
F025-F031	Reserved			

Value range Process line selection

Bit 1	Bit 0	Description
0	0	Process line 1 (default)
0	1	Process line 2
1	0	Process line 3
1	1	Reserved

Value range for process line selection

Value Range for TWIN Mode

Bit 1	Bit 0	Description
0	0	TWIN Single mode
0	1	TWIN Lead mode
1	0	TWIN Trail mode
1	1	Reserved

Value range for TWIN mode

Value Range for Documentation mode

Bit 0	Description
0	Seam number of power source (internal)
1	Seam number of robot

Value range for documentation mode

Value range for Working mode

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	Internal welding parameter selection
0	0	0	0	1	Special 2-step mode characteristics
0	0	0	1	0	Job mode
0	1	0	0	0	2-step mode characteristics
1	0	0	0	1	Stop cooling unit
0	1	0	0	1	2-Step manual mode

Value range for operating mode

Value Range for Command value selection

Bit 14	Description
0	Wirefeeder set value
1	Welding current set value

Value range for set value

Output Signals **From power source to robot**
Applicable to firmware V3.5.0 and higher

HEX address	Signal		Type	Unit/Area	Factor
F100	Status Flag Group 1				
	Bits 0–15	Reserved			
F101	Status Flag Group 2				
	Bit 0	Heartbeat Powersource	Boolean	1 Hz	
	Bit 1	Power source ready	Boolean		
	Bit 2	Arc stable	Boolean		
	Bit 3	Current flow	Boolean		
	Bit 4	Main current signal	Boolean		
	Bit 5	Torch collision protection	Boolean		
	Bit 6	Reserved			
	Bit 7	Reserved			
	Bit 8	Touch signal	Boolean		
	Bit 9	Torchbody connected	Boolean		
	Bit 10	Command value out of range	Boolean		
	Bit 11	Correction out of range	Boolean		
	Bit 12	Process active	Boolean		
	Bit 13	RobotMotionRelease	Boolean		
	Bit 14	Wire stick workpiece	Boolean		
	Bit 15	Reserved			
F102	Status Flag Group 3				
	Bit 0	Welding Mode Bit 0	Boolean	See **Value range for welding process and process image** on page **58**	
	Bit 1	Welding Mode Bit 1	Boolean		
	Bit 2	Welding Mode Bit 2	Boolean		
	Bit 3	Welding Mode Bit 3	Boolean		
	Bit 4	Welding Mode Bit 4	Boolean		
	Bits 5–7	Reserved			
	Bit 8	Parameter selection internally	Boolean		
	Bit 9	Characteristic number valid	Boolean		
	Bits 10–13	Reserved			
	Bit 14	Process image Bit 0	Boolean	See **Value range for welding process and process image** on page **58**	
	Bit 15	Process image Bit 1	Boolean		

HEX address	Signal		Type	Unit/Area	Factor
F103	Status Flag Group 4				
	Bit 0	Penetration stabilizier	Boolean		
	Bit 1	Arclength stabilizier	Boolean		
	Bits 2–13	Reserved			
	Bit 14	Short circuit contact tip	Boolean		
	Bit 15	Gas nozzle touched	Boolean		
F104	Status Flag Group 5				
	Bit 0	Sensor status 1 High	Boolean	See **Assignment of Sensor Statuses 1–4** on page **59**	
	Bit 1	Sensor status 2 High	Boolean		
	Bit 2	Sensor status 3 High	Boolean		
	Bit 4	Sensor status 4 High	Boolean		
	Bits 4–10	Reserved			
	Bit 11	Safety status Bit 0	Boolean	See **Value range Safety status** on page **59**	
	Bit 12	Safety status Bit 1	Boolean		
	Bit 13	Reserved			
	Bit 14	Notification	Boolean		
	Bit 15	System not ready	Boolean		
F105	Status Flag Group 6				
	Bit 0	Limit Signal	Boolean		
	Bits 1–7	Reserved			
	Bit 8	Reserved			
	Bit 9	TWIN synchronization active	Boolean		
	Bit 10	Main supply status	Boolean		
	Bits 11–13	Reserved			
	Bit 14	Warning	Boolean		
	Bit 15	Reserved			
F106	Status Flag Group 7				
	Bits 0–15	Reserved	Boolean		
F107	Status Flag Group 8				
	Bit 0	ExtOutput1 <= OPT_Input1	Boolean		
	Bit 1	ExtOutput2 <= OPT_Input2	Boolean		
	Bit 2	ExtOutput3 <= OPT_Input3	Boolean		
	Bit 3	ExtOutput4 <= OPT_Input4	Boolean		
	Bit 4	ExtOutput5 <= OPT_Input5	Boolean		
	Bit 5	ExtOutput6 <= OPT_Input6	Boolean		
	Bit 6	ExtOutput7 <= OPT_Input7	Boolean		
	Bit 7	ExtOutput8 <= OPT_Input8	Boolean		
	Bits 8–15	Reserved	Boolean		

HEX address	Signal	Type	Unit/Area	Factor
F108	Main error number	UINT16	0 to 65535	
F109	Warning number	UINT16	0 to 65535	1
F10A	Welding voltage actual value	UINT16	0.0 to 327.67 volts	100
F10B	Welding current actual value	UINT16	0.0 to 3276.7 amperes	10
F10C	Motor current actual value M1	SINT16	-327.68 to 327.67 amperes	100
F10D	Motor current actual value M2	SINT16	-327.68 to 327.67 amperes	100
F10E	Motor current actual value M3	SINT16	-327.68 to 327.67 amperes	100
F10F	Reserved			
F110	Wire speed actual value	SINT16	-327.68 to 327.67 m/min	100
F111	Seam tracking actual value	UINT16	0 to 6.5535	10000
F112	Real energy actual value	UINT16	0 to 6553.5 kilo-joules	10
F113	Wire position	SINT16	-327.68 to 327.67 mm	100
F114-F131	Reserved			

Value range for welding process and process image

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	Internal mode selection
0	0	0	0	1	MIG/MAG pulsed synergic
0	0	0	1	0	MIG/MAG standard synergic
0	0	0	1	1	MIG/MAG PMC
0	0	1	0	0	MIG/MAG LSC
0	0	1	0	1	MIG/MAG standard manual
0	0	1	1	0	Electrode
0	0	1	1	1	TIG
0	1	0	0	0	CMT

Value range for welding process

Bit 15	Bit 14	Description
0	0	Standard image (Weldcom V2.0)
1	0	Retrofit image (Weldcom TPS series)

Value range for process image

Assignment of Sensor Statuses 1–4

Signal	Description
Sensor status 1	OPT/i WF R wire end (4,100,869)
Sensor status 2	OPT/i WF R wire drum (4,100,879)
Sensor status 3	OPT/i WF R ring sensor (4,100,878)
Sensor status 4	Wire buffer set CMT TPS/i (4,001,763)

Value range Safety status

Bit 1	Bit 0	Description
0	0	Reserve
0	1	Hold
1	0	Stop
1	1	Not installed / active

TAG table

- To read the following TAGs, use the mode function 03dec (03hex) - see section **103_{dec} (67_{hex}) Read Holding Register Float** from page **76**
- To edit the following TAGs, use the mode function 06dec (06hex) - see section **104_{dec} (68_{hex}) Write Single Register Float** from page **77**

HEX address	Signal	Access	Type	Range	Unit	Step size
E064	Gas preflow [Gpr]	Reading & writing	FLOAT	0.0 to 9.9	s	0.1
E065	Gas postflow [Gpo]	Reading & writing	FLOAT	0.0 to 9.9	s	0.1
F10B	Error number	Reading	FLOAT	0 to 65,535		1
E062	Min. feeder value	Reading	FLOAT	0.0 to 100.0	m/min	0.1
E063	Max. feeder value	Reading	FLOAT	0.0 to 100.0	m/min	0.1
E0A3	Inching speed [Fdi]	Reading & writing	FLOAT	0.5 to vD-max	m/min	0.1
E032	SynchroPulse DeltaWireFeed	Reading & writing	FLOAT	0.1 to 6.0	m/min	10
E031	SynchroPulse Frequency	Reading & writing	FLOAT	0.5 to 10.0	Hz	10
E033	SynchroPulse DutyCycle	Reading & writing	FLOAT	10 to 90	%	1

HEX address	Signal	Access	Type	Range	Unit	Step size
E034	SynchroPulse ArcLength Correction High	Reading & writing	FLOAT	-10.0 to 10.0		10
E035	SynchroPulse ArcLength Correction Low	Reading & writing	FLOAT	-10.0 to 10.0		10
E06A	Starting current [I-S]	Reading & writing	FLOAT	0.0 to 200.0	%	1
E06B	Slope 1	Reading & writing	FLOAT	0.0 to 9.9	s	10
E06C	Slope 2	Reading & writing	FLOAT	0.0 to 9.9	s	10
E06D	End current [I-E]	Reading & writing	FLOAT	0.0 to 200.0	%	1
E056	Starting Current Time [t-S]	Reading & writing	FLOAT	0.0 to 10.0	s	10
E057	End Current Time [t-e]	Reading & writing	FLOAT	0.0 to 10.0	s	10
E02E	SFI HotStart	Reading & writing	FLOAT	0.01 to 2.00	s	100
E06F	Language	Reading & writing	FLOAT	See the following table		
E0A6	Hourmeter Current flow	Reading	FLOAT	0.0 to 1,000,000	h	0.1
E0A7	Hourmeter Power on	Reading	FLOAT	0.0 to 1,000,000	h	0.1
E0AA	Power value	Reading	FLOAT	0.0 to 1,000,000	kW	0.1
E0AB	Real energy value	Reading	FLOAT	0.0 to 1,000,000	kJ	0.1
E0BB	Coolertemperature	Reading	FLOAT	-100 to 200	°C	0.1
E0BC	Coolerflow	Reading	FLOAT	-100 to 100	l/min	0.1

Table Language	
Value	**Language**
8E+34	English
9E+34	German
58e34	Japanese
10e34	Chinese
23e34	Spanish

Table Language	
Value	**Language**
24e34	French
25e34	Czech
26e34	Hungarian
27e34	Italian
28e34	Norwegian
29e34	Polish
30e34	Portuguese
31e34	Slovak
32e34	Turkish
33e34	Russian
34e34	Swedish
35e34	Estonian
36e34	Finnish
39e34	Lithuanian
40e34	Latvian
41e34	Dutch
42e34	Slovenian
43e34	Romanian
44e34	Croatian
59e34	Ukrainian
61e34	Korean
66e34	Icelandic
67e34	Vietnamese
70e34	Thai
71e34	Indonesian
75e34	Serbian
76e34	Hindi
130e34	Tamil
151e34	Danish
156e34	Bulgarian

Input and output signals - retrofit image Weldcom TPS series

Input signals **From robot to power source**
Applicable to firmware V1.9.0 and higher

HEX address	Signal		Type	Range / Unit	Factor
F000	Control Flag Group 1				
	Bits 0 to 7	Process active timeout	Byte	[ms]	10
	Bits 8 to 15	Reserved			
F001	Control Flag Group 2				
	Bit 0	Welding start	Boolean		
	Bit 1	Robot ready	Boolean		
	Bit 2	Source error reset	Boolean		
	Bit 3	Gas test	Boolean		
	Bit 4	Wire inching	Boolean		
	Bit 5	Wire retract	Boolean		
	Bit 6	Torch blow out	Boolean		
	Bit 7	Welding simulation	Boolean		
	Bit 8	Touch sensing	Boolean		
	Bit 9	Reserved			
	Bit 10	SFI on	Boolean		
	Bit 11	Synchro pulse on	Boolean		
	Bits 12 to 13	Reserved			
	Bit 14	Power full range	Boolean		
	Bit 15	Reserved			
F002	Control Flag Group 3				
	Bits 0 to 15	Reserved			
F003	Control Flag Group 4				
	Bits 0 to 15	Reserved			
F004	Control Flag Group 5				
	Bits 0 to 15	Reserved			
F005	Control Flag Group 6				
	Bits 0 to 15	Reserved			

HEX address	Signal		Type	Range / Unit	Factor
F006	Control Flag Group 7				
	Bits 0 to 15	Reserved			
F007	Control Flag Group 8				
	Bits 0 to 15	Reserved			
F008	Operating mode			See table **Value Range for Operating Mode** on page **64**	
	Bit 0	Operating mode 0	Boolean		
	Bit 1	Operating mode 1	Boolean		
	Bit 2	Operating mode 2	Boolean		
	Bit 3	Operating mode 3	Boolean		
	Bits 4 to 15	Reserved	Boolean		
F009	Job number		Byte	0 to 255	
F00A	Program number		Byte	0 to 127	
F00B	Power		Word	0 to 65,535 (0 to 100%)	
F00C	Arc length correction		Word	0 to 65,535 (-10 to +10%)	
F00D	Pulse-/dynamic correction		Byte	0 to 255 (-5 to +5%)	
F00E	Reserved				
F00F	Reserved				
F010	Reserved				
F011	Reserved				
F012	Reserved				
F013	Reserved				
F014	Reserved				
F015	Reserved				
F016	Reserved				
F017	Reserved				
F018	Reserved				
F019	Reserved				
F01A	Reserved				
F01B	Reserved				
F01C	Reserved				
F01D	Reserved				
F01E	Reserved				

Value Range for Operating Mode

Bit 4-15	Bit 3	Bit 2	Bit 1	Bit 0	Description
-	0	0	0	0	MIG standard
-	0	0	0	1	MIG pulse
-	0	0	1	0	Job mode
-	0	0	1	1	Internal parameter selection/special 2-step mode
-	0	1	0	0	Synergic operation/special 2-step mode
-	0	1	0	1	Synergic operation/special 2-step mode
-	0	1	1	0	MIG standard manual
-	0	1	1	1	Synergic operation/special 2-step mode
-	1	0	0	0	MIG LSC
-	1	0	0	1	MIG PMC

Output signals **From power source to robot**
Applicable to firmware V1.9.0 and higher

HEX address	Signal		Type	Range / Unit	Factor
F100	Status Flag Group 1				
	Bits 0 to 15	Reserved	Boolean		
F101	Status Flag Group 2				
	Bit 0	Communication ready	Boolean		
	Bit 1	Power source ready	Boolean		
	Bit 2	Arc stable	Boolean		
	Bit 3	Process active	Boolean		
	Bit 4	Main current signal	Boolean		
	Bit 5	Torch collision protection	Boolean		
	Bit 6	Wire stick control	Boolean		
	Bit 7	Wire available	Boolean		
	Bit 8	Short circuit timeout	Boolean		
	Bit 9	Power out of Range	Boolean		
	Bits 10 to 11	-	Boolean		
	Bit 12	Limit signal High	Boolean		
	Bits 13 to 15	-	Boolean		
F102	Status Flag Group 3				
	Bits 0 to 13	Reserved			
	Bit 14	Process image Bit 0	Boolean		
	Bit 15	Process image Bit 1	Boolean		
F103	Status Flag Group 4				
	Bits 0 to 15	Reserved			
F104	Status Flag Group 5				
	Bits 0 to 15	Reserved			
F105	Status Flag Group 6				
	Bits 0 to 15	Reserved			
F106	Status Flag Group 7				
	Bits 0 to 15	Reserved			

HEX address	Signal		Type	Range / Unit	Factor
F107	Status Flag Group 8				
	Bits 0 to 15	Reserved			
F108	Main error number		Word		
F109	Reserved				
F10A	Welding voltage actual value		Word	0 to 65,535 (0 to 100 V)	
F10B	Welding current actual value		Word	0 to 65,535 (0 to 1000 A)	
F10C	Motor current actual value		Byte	0 to 255 (0 to 5 A)	
F10D	Reserved				
F10E	Reserved				
F10F	Reserved				
F110	Wire speed actual value		Word	0 to vDmax	100
F111	Reserved				
F112	Reserved				

TAG Table

- To read the following TAGs, use the mode function 03dec (03hex) - see section **03_{dec} (03_{hex}) Read Holding Register** from page **70**
- To edit the following TAGs, use the mode function 06dec (06hex) or 16_{dec} (10_{hex}) - see section **06_{dec} (06_{hex}) Write Single Register** from page **71** / section **16_{dec} (10_{hex}) Write Multiple Register** from page **73**

HEX address	Description	Reading / writing	Unit	Type	Step size
E011	Gas preflow [Gpr]	Reading / writing	s	Word	0.001
E012	Gas postflow [Gpo]	Reading / writing	s	Word	0.001
E000	Error number	Read only			1
E072	Min. feeder value	Read only	m/min	Word	0.01
E073	Max. feeder value	Read only	m/min	Word	0.01
E013	Inching speed [Fdi]	Reading / writing	m/min	Word	0.01
E015	Power offset [dFd]	Reading / writing	m/min	Word	0.01
E016	SynchroPulse Frequency	Reading / writing	Hz	Word	0.1
E01D	Starting current [I-S]	Reading / writing	%	Word	0.1
E01F	Slope 1 + Slope 2	Reading / writing	s	Word	0.001
E020	End current [I-E]	Reading / writing	%	Word	0.1

HEX address	Description	Reading / writing	Unit	Type	Step size
E01E	Starting Current Time [t-S]	Reading / writing	s	Word	OFF = 0.0 and 0.1
E021	End Current Time [t-e]	Reading / writing	s	Word	
E007	Arc length correction 2 (Al2)	Reading / writing	%	Word	0.1

Modbus – General Information

Protocol Description

The MODBUS ADU is constructed by the client that initiates the MODBUS transaction. The function tells the server which action is to be performed. The MODBUS application protocol defines the format of a client-initiated request.

The function code field of a MODBUS data unit is coded in one byte. Valid codes are in the range of 1 ... 255 decimal (the range 128-255 is reserved for exception responses). When the server receives a message from a client, the function code field tells the server which action to perform.

If several actions are to be performed, subfunction codes are added to some function codes. When messages are sent to servers by a client, the data field in the message contains additional information that the server uses to perform the action defined by the function code. This can include elements such as discrete addresses, register addresses, the quantity to be handled, or the number of actual data bytes contained within the field.

With certain types of request, there might not be a data field (length: zero). In this case, the server does not require any additional information because the action is specified by the function code alone.

If a MODBUS ADU is correctly received without any errors occurring in connection with the requested MODBUS function, the requested data will be included in the data field when a server responds to a client. If an error does occur in connection with the requested MODBUS function, the field will contain an exception code that the server application can use to determine what action to perform next.

For instance, a client can read the ON/OFF statuses of a group of discrete inputs or outputs, or it can read/write the data contents of a group of registers.

When sending a response to the client, the server uses the function code field either to indicate that the response is normal (free of errors) or that an error has occurred (this kind of response is called an "exception response"). In the case of a normal response, the server simply echoes the original function code.

Data Coding

For addresses and data elements, MODBUS uses a big-endian format. When a number larger than a single byte is transmitted, this means that the most significant byte is sent first.

Register Size	Value
16 bits, 1234_{hex}	12_{hex} is sent as the first byte and then 34_{hex}

Application Data Unit (ADU)

This section describes the encapsulation method used for a MODBUS request or response when it is transmitted over a MODBUS TCP network.

MPAP header	Function code	Data

Description of MPAP header:	
Transaction Identifier Used to allocate the transaction. The MODBUS server copies the Transaction Identifier of the request into the response.	
Transaction Identifier This is used for transaction pairing. The MODBUS server copies the transaction identifier from the request into the response.	
Length:	2 bytes
Description:	For identifying a MODBUS request/response transaction
Client:	Initialized by the client
Server:	Copied back by the server from the request received
Protocol Identifier This is used for multiplexing within the system. The MODBUS protocol is identified by the value 0.	
Length:	2 bytes
Description:	0 = Modbus protocol
Client:	Initialized by the client
Server:	Copied back by the server from the request received
Length This field is used to specify the number of bytes in the field to follow, including the unit identifier, function code, and data field.	
Length:	2 bytes
Description:	Number of bytes to follow
Client:	Initialized by the client
Server:	-
Unit Identifier This field is used for routing within the system. It is usually used for communication with a serially connected MODBUS- or MODBUS+ slave where communication takes place via a gateway between an Ethernet network and a serial MODBUS line. The field value is set in the request by the MODBUS client and must be replicated exactly in the response from the server.	
Length:	1 byte
Description:	For identifying a remote slave that is connected via a serial line or other type of bus.
Client:	Initialized by the client

All MODBUS/TCP ADUs are sent via TCP on registered port 502.

Modbus Functions

03_{dec} (03_{hex}) Read Holding Register

This code is used to read the contents of a contiguous block of holding registers in a remote device. The request PDU determines the starting register address and the number of registers.
The registers are addressed in the PDU starting at zero. This means registers numbered 1-16 will be addressed using 0-15.

The register data in the response message is packed as two bytes per register, with the binary contents precisely aligned/justified within each byte. Within the individual registers, the first byte contains the high-order bits and the second byte the low-order bits.

Request		
Function code	1 byte	03_{hex}
Start address	2 bytes	0000_{hex} to $FFFF_{hex}$
Number of registers	2 bytes	1 to 125 ($7D_{hex}$)

Response		
Function code	1 byte	03_{hex}
Number of bytes	2 bytes	2 x N*
Register value	N* x 2 bytes	-
N* = Number of registers		

Errors		
Error code	1 byte	83_{hex}
Exception code	1 byte	01 or 02 or 03 or 04

Example
Example of a read request for register F009 (job number).

Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Transaction Identifier Hi	00	Transaction Identifier Hi	00
Transaction Identifier Lo	01	Transaction Identifier Lo	01
Protocol Identifier Hi	00	Protocol Identifier Hi	00
Protocol Identifier Lo	00	Protocol Identifier Lo	00
Length Hi	00	Length Hi	00
Length Lo	06	Length Lo	05
Unit Identifier	00	Unit Identifier	00
Function code	03	Function code	03
Starting Address Hi	F0	Byte Count	02
Starting Address Lo	F9	Register value Hi (108)	02
No. of Registers Hi	00	Register value Lo (108)	37

Example Example of a read request for register F009 (job number).			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
No. of Registers Lo	01		

The contents of register F009 (job number) are displayed in the form of the two-byte values 237_{hex} or 567_{dec}.

06_{dec} (06_{hex}) Write Single Register

This function code is used to write a single holding register in a remote device. The request PDU specifies the address of the register to be written. Registers are addressed starting at zero. This means that the register that has been numbered as 1 will be addressed using 0.
The normal response is an echo of the request, which is returned after the register contents are written.

Request		
Function code	1 byte	06_{hex}
Register address	2 bytes	0000_{hex} to $FFFF_{hex}$
Register value	2 bytes	0000_{hex} or $FFFF_{hex}$

Response		
Function code	1 byte	06_{hex}
Register address	2 bytes	0000_{hex} to $FFFF_{hex}$
Register value	2 bytes	0000_{hex} or $FFFF_{hex}$

Errors		
Error code	1 byte	86_{hex}
Exception code	1 byte	01 or 02 or 03 or 04

Example Example request for writing the value 237_{hex} (567_{dec}) to register F009 (job number).			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Transaction Identifier Hi	00	Transaction Identifier Hi	00
Transaction Identifier Lo	01	Transaction Identifier Lo	01
Protocol Identifier Hi	00	Protocol Identifier Hi	00
Protocol Identifier Lo	00	Protocol Identifier Lo	00
Length Hi	00	Length Hi	00
Length Lo	06	Length Lo	06
Unit Identifier	00	Unit Identifier	00
Function code	06	Function code	06
Register Address Hi	F0	Register Address Hi	F0

Example **Example request for writing the value 237_{hex} (567_{dec}) to register F009 (job number).**			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Register Address Lo	09	Register Address Lo	09
Register Value Hi	02	Register Value Hi	02
Register Value Lo	37	Register Value Lo	37

16_{dec} (10_{hex}) Write Multiple Register

This function code is used to write a block of contiguous registers in a remote device. The requested written values are specified in the request data field. Data is packed as two bytes per register. The normal response returns the function code, the starting address, and the number of registers written.

Request		
Function code	1 byte	10_{hex}
Starting address	2 bytes	0000_{hex} to $FFFF_{hex}$
Number of registers	2 bytes	0001_{hex} or 0078_{hex}
Number of bytes	1 byte	2 x N*
Register values	N* x 2 bytes	Value
N* = number of registers to be written		

Response		
Function code	1 byte	10_{hex}
Starting address	2 bytes	0000_{hex} to $FFFF_{hex}$
Number of registers	2 bytes	1 to 123 ($7B_{hex}$)

Errors		
Error code	1 byte	90_{hex}
Exception code	1 byte	01 or 02 or 03 or 04

Example
Example request for writing two registers ($F00B_{hex}$ – $F00C_{hex}$).

Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Transaction Identifier Hi	00	Transaction Identifier Hi	00
Transaction Identifier Lo	01	Transaction Identifier Lo	01
Protocol Identifier Hi	00	Protocol Identifier Hi	00
Protocol Identifier Lo	00	Protocol Identifier Lo	00
Length Hi	00	Length Hi	00
Length Lo	11	Length Lo	11
Unit Identifier	00	Unit Identifier	00
Function code	10	Function code	10
Starting Address Hi	F0	Starting Address Hi	F0
Starting Address Lo	0B	Starting Address Lo	0B
Quantity of Registers Hi	00	Quantity of Registers Hi	00
Quantity of Registers Lo	02	Quantity of Registers Lo	02
Byte Count	04		
Register Value Hi	04		
Register Value Lo	CE		

Example **Example request for writing two registers ($F00B_{hex}$ – $F00C_{hex}$).**			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Register Value Hi	FF		
Register Value Lo	C0		

23_{dec} (17_{hex}) Read/Write Multiple Register

This function code performs a combination of one read operation and one write operation in a single MODBUS transaction. The write operation is performed before the read operation.
Holding registers are addressed starting at zero. This means that holding registers 1-16 will be addressed in the PDU using 0-15.

The request PDU specifies:
- The starting address and number of holding registers to be read
- The starting address, number of holding registers, and data for the write operation.

The byte count field specifies the number of bytes to follow in the write data field.

The normal response contains the data from the group of registers read. The byte count field specifies the number of bytes to follow in the read data field.

Request		
Function code	1 byte	17_{hex}
Read starting address	2 bytes	0000_{hex} to $FFFF_{hex}$
Number of registers to read	2 bytes	0001_{hex} to approx. 0076_{hex}
Write starting address	2 bytes	0000_{hex} to $FFFF_{hex}$
Number of registers to write	2 bytes	0001_{hex} to approx. 0076_{hex}
Write number of bytes	1 byte	2 x N*
Write register values	N* x 2 bytes	
N* = number of registers to be written		

Response		
Function code	1 byte	17_{hex}
Number of bytes	1 byte	2 x N*
Write register values	N* x 2 bytes	
N* = number of registers to be read		

Errors		
Error code	1 byte	97_{hex}
Exception code	1 byte	01 or 02 or 03 or 04

Example **Example request for reading 2 registers and writing 2 registers.**			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Transaction Identifier Hi	00	Transaction Identifier Hi	00

Example Example request for reading 2 registers and writing 2 registers.			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
Transaction Identifier Lo	01	Transaction Identifier Lo	01
Protocol Identifier Hi	00	Protocol Identifier Hi	00
Protocol Identifier Lo	00	Protocol Identifier Lo	00
Length Hi	00	Length Hi	00
Length Lo	11	Length Lo	7
Unit Identifier	00	Unit Identifier	00
Function code	17	Function code	17
Read Starting Address Hi	F1	Byte Count	2
Read Starting Address Lo	0A	Read Registers Value Hi	04
Quantity to Read Hi	00	Read Registers Value Lo	08
Quantity to Read Lo	2	Read Registers Value Hi	0A
Write Starting Address Hi	F0	Read Registers Value Lo	C8
Write Starting Address Lo	0B		
Quantity to Write Hi	00		
Quantity to Write Lo	04		
Write Byte Count	2		
Write Registers Value Hi	04		
Write Registers Value Lo	CE		
Write Registers Value Hi	FF		
Write Registers Value Lo	C0		
Transaction Identifier Hi	00		

103_{dec} (67_{hex}) Read Holding Register Float

This function is used to read the contents of a contiguous block of registers in the TAG tables contained in this document. The register uses floating-point format (32 bits). The request PDU determines the starting register address and the number of registers.
The registers are addressed in the PDU starting at zero. This means registers numbered 1-16 will be addressed using 0-15.

The register data in the response message is packed as two bytes per register, with the binary contents precisely aligned/justified within each byte. Within the individual registers, the first byte contains the high-order bits and the second byte the low-order bits.

Requirement		
Function code	1 byte	xx_{hex}
Starting address	2 bytes	$xxxx_{hex}$ to $xxxx_{hex}$
Number of registers	2 bytes	1 to 125 ($7D_{hex}$)

Response		
Function code	1 byte	03_{hex}
Number of bytes	2 bytes	2 x N*
Register value	N* x 2 bytes	-
N* = number of registers		

Error		
Error code	1 bytes	83_{hex}
Exception code	1 byte	01 or 02 or 03 or 04

Example Example read request for register $E064_{hex}$ (gas pre-flow):			
Requirement		**Response**	
Field Name	**Hex**	**Field Name**	**Hex**
Transaction Identifier Hi	00	Transaction Identifier Hi	00
Transaction Identifier Lo	01	Transaction Identifier Lo	01
Protocol Identifier Hi	00	Protocol Identifier Hi	00
Protocol Identifier Lo	00	Protocol Identifier Lo	00
Length Hi	00	Length Hi	00
Length Lo	06	Length Lo	05
Unit Identifier	00	Unit Identifier	00
Function code	67	Function code	67
Starting Address Hi	E0	Byte Count	02
Starting Address Lo	64	Register Value High Hi	3F
No. of Registers Hi	00	Register Value High Lo	C0
No. of Registers Lo	01	Register Value Low Hi	00
		Register Value Low Lo	00

The contents of register $E064_{hex}$ (gas pre-flow) are displayed in the form of the two-byte values 3FC00000 or 1.5_{dec}.

104_{dec} (68_{hex}) Write Single Register Float

This function is used to edit registers in the TAG tables contained in this document. The register uses floating-point format (32 bits). The request PDU specifies the address of the register to be written. Registers are addressed starting at zero. This means that the register that has been numbered as 1 will be addressed using 0.
The normal response is an echo of the request, which is returned after the register contents are written.

Requirement		
Function code	1 byte	68_{hex}
Register address	2 bytes	$E000_{hex}$ to $Exxx_{hex}$
Register value	2 bytes	0000_{hex} or $FFFFFFFF_{hex}$

Response		
Function code	1 byte	68_{hex}
Register address	2 bytes	$E000_{hex}$ to $Exxx_{hex}$
Register value	2 bytes	0000_{hex} or $FFFFFFFF_{hex}$

Error		
Error code	1 bytes	$E8_{hex}$
Exception code	1 byte	01 or 02 or 03

Example
Example request for writing the value $3FC00000_{hex}$ (1.5_{dec}) to register $E064_{hex}$ (gas pre-flow):

Requirement		Response	
Field Name	**Hex**	**Field Name**	**Hex**
Transaction Identifier Hi	00	Transaction Identifier Hi	00
Transaction Identifier Lo	01	Transaction Identifier Lo	01
Protocol Identifier Hi	00	Protocol Identifier Hi	00
Protocol Identifier Lo	00	Protocol Identifier Lo	00
Length Hi	00	Length Hi	00
Length Lo	08	Length Lo	08
Unit Identifier	00	Unit Identifier	00
Function code	68	Function code	68
Register Address Hi	E0	Register Address Hi	E0
Register Address Lo	64	Register Address Lo	64
Register Value High Hi	3F	Register Value Hi	45
Register Value High Lo	C0	Register Value Lo	09
Register Value Low Hi	00	Register Value Hi	80
Register Value Low Lo	00	Register Value Lo	00

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