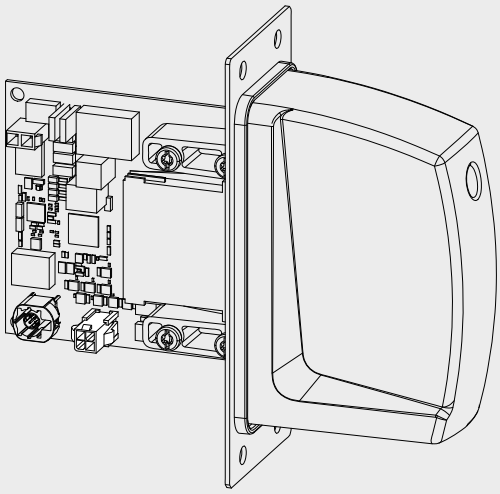
RI FB/i Yaskawa WeldCom 2.0
RI MOD/i CC Modbus TCP-2P

EN-US

Operating instructions



42,0426,0218,EA 029-11012022

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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!

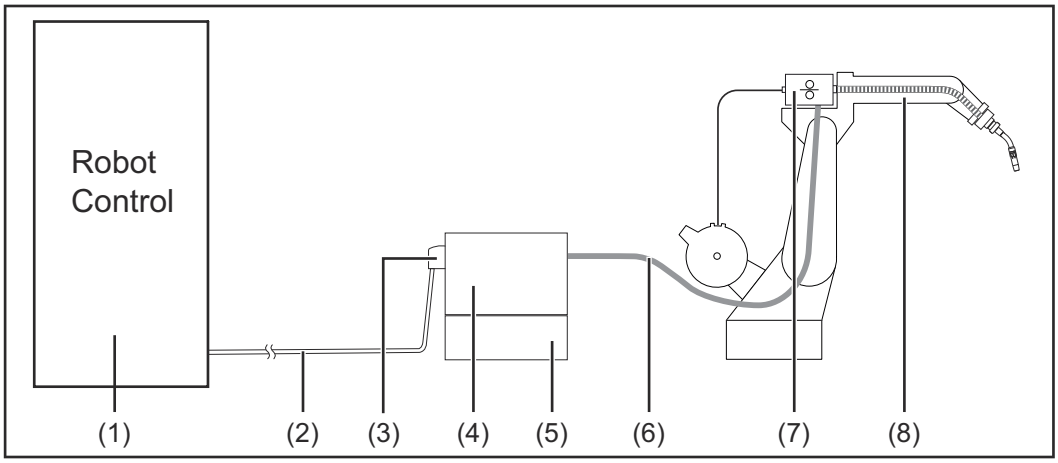
Danger from electrical current.
This can result in serious personal injury and damage to property.
- ▶ Before starting work, switch off all devices and components involved, and disconnect them from the grid.
- ▶ Secure all devices and components involved so they cannot be switched back on.

⚠ 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

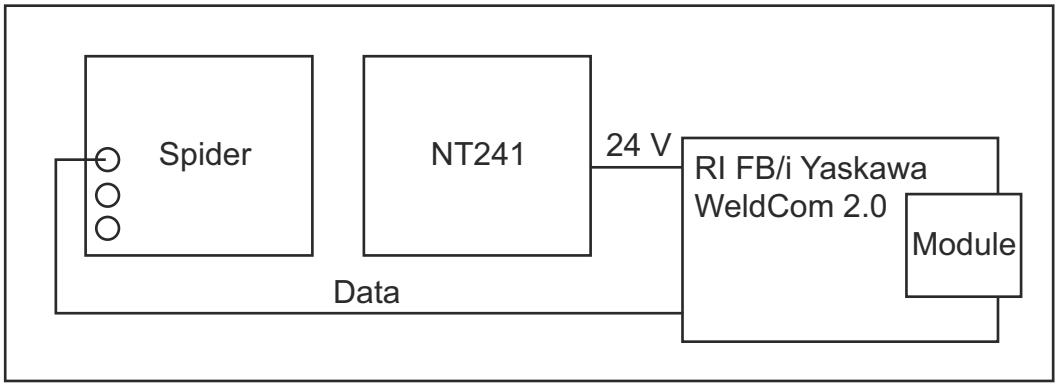
The robot interface serves as an interface between the power source and standardized bus modules supporting a wide range of communication protocols.
Fronius may factory-fit the robot interface in the power source but it can also be retrofitted by appropriately trained and qualified personnel.



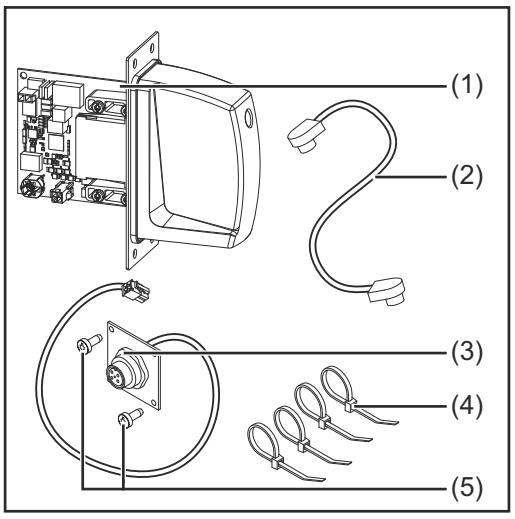
(1)	**Robot control system**
(2)	**SpeedNet data cable**
(3)	**Robot interface**
(4)	**Power source**

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

Block Diagram



Scope of Supply



(1)	**RI FB/i Yaskawa WeldCom 2.0**
(2)	**Data cable 4-pin**
(3)	**M12 connection (5-pin) with connection cable**
(4)	**Cable ties**
(5)	**2 screws for M12 connection**
(6)	**These Operating Instructions (not pictured)**

Required Tools and Materials

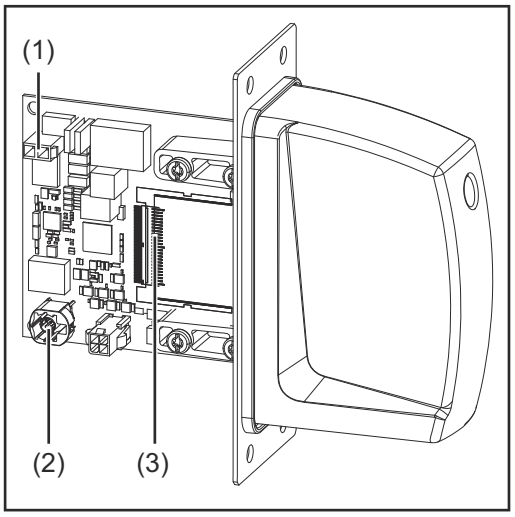
- Screwdriver TX8
- Screwdriver TX20
- Screwdriver TX25
- Diagonal cutting pliers

Installation Requirements

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

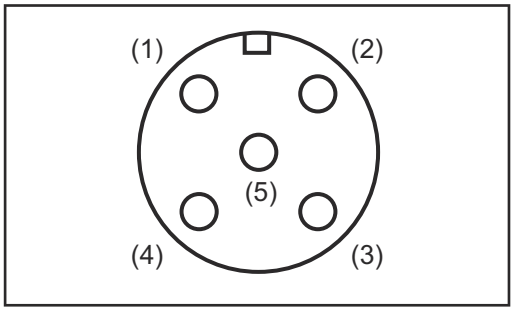
Connections and Indicators

Connections on the Robot Interface



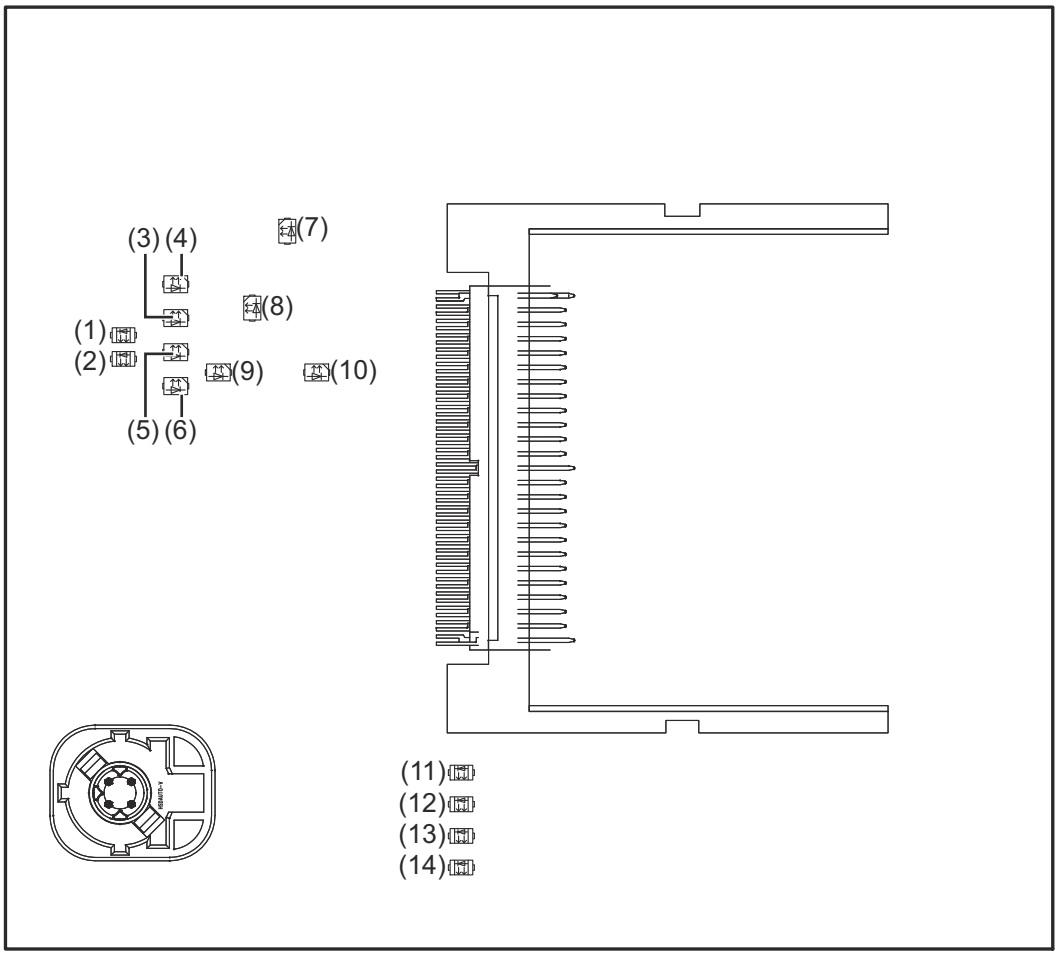
(1)	**Power supply connection 2-pin**
(2)	**SpeedNet data cableconnection 4-pin**
(3)	**Bus module connection**

Pin Assignment of M12 Connection



	WeldCom 2.0	Retrofit
(1)	CAT signal	CAT signal
(2)	Touched	Arc stable
(3)	CAT signal GND	CAT signal GND
(4)	Touched GND	Arc stable GND
(5)	n.c (not connected)	

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	

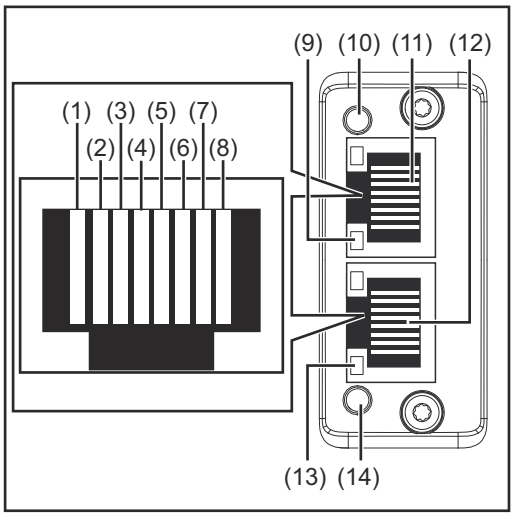
LEDs for Power Supply Diagnosis

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 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"

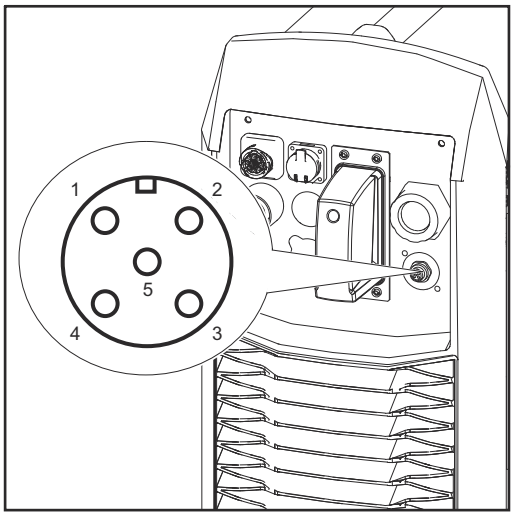
Module Status LED:	
Status	**Meaning**
Off	No supply voltage
Lights up green	Normal operation
Lights up red	Major error (exception state, serious fault, etc.)
Flashes red	Minor error
Alternates between red and green	Firmware update in progress

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)

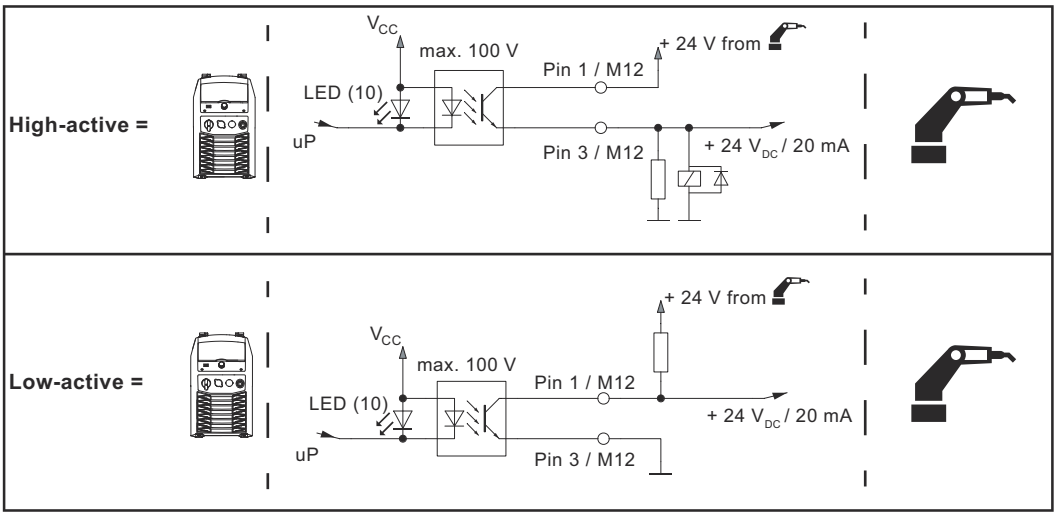
Link/Activity LED:	
Status	**Meaning**
Flickers yellow	Activity (10 Mbit/s)

Examples of How the M12 Connection Is Used

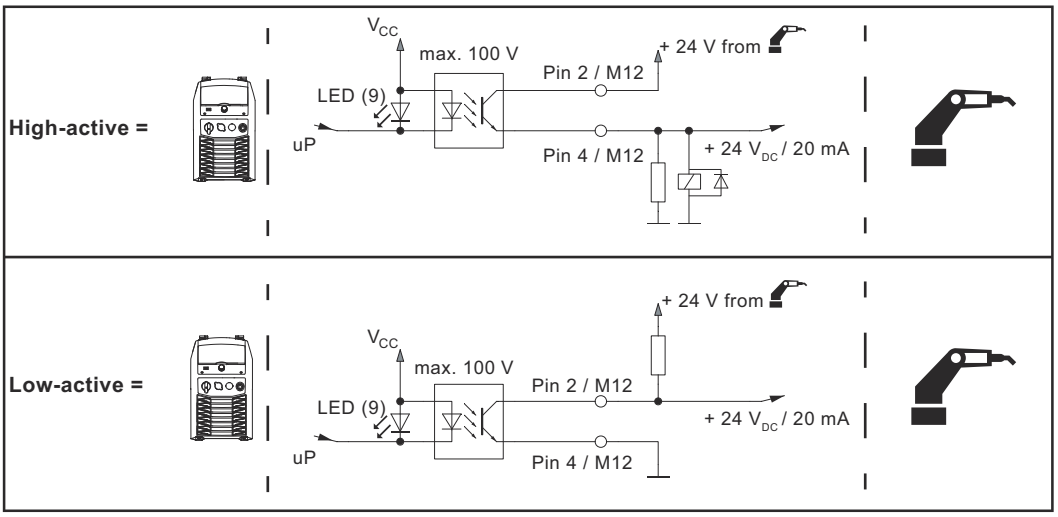
Examples of How the M12 Connection Is Used



M12 Connection on Power Source



CAT signal (DIG OUT 1)



WeldCom 2.0 = Touched, Retrofit = Arc Stable (DIG OUT 2)

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

RJ-45 Connection
Transmission technology: Ethernet
Medium (4 x 2 twisted-pair copper cable): Category 5 (100 Mbit/s) or higher
Transmission speed: 10 Mbit/s or 100 Mbit/s
Bus connection: Ethernet RJ-45

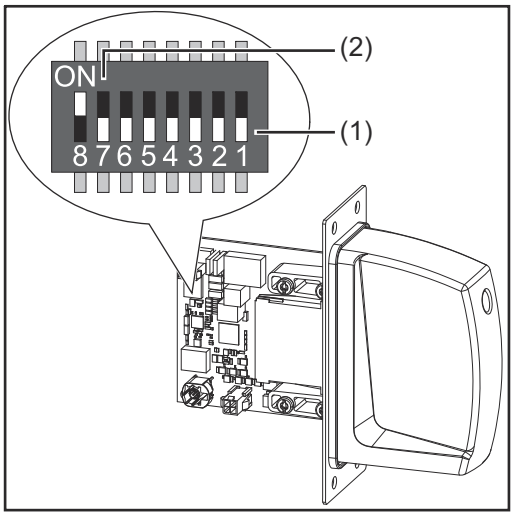
M12 Connection
Voltage: 24 V
Current load per output: Max. 20 mA

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	0340_{hex} (832_{dec})
Major / Minor Revision	V1.00
Vendor URL	www.fronius.com
Product Name	yaskawa-weldcom2-0-modbus-tcp
Model Name	yaskawa-weldcom2-0
User Application Name	Fronius welding controller for the series TPS/i WeldCom2.0 (ModbusTCP)

Configuration of robot interface

General



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

Default setting for process image:
Positions 7 and 8 of DIP switch set to OFF (1) = standard image = Weldcom V2.0

Default setting for IP address = 192.168.255.210:
- Positions 6, 5, 3, and 1 of DIP switch set to OFF (1)
- Positions 2 and 4 of DIP switch set to ON (2)

Configuring 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 switch within the range defined by 192.168.255.2xx (xx = DIP switch setting = 01 to 55)

Setting the Address via the DIP Switch:								
DIP Switch								IP Address
8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
-	-	OFF	OFF	OFF	OFF	OFF	ON	192.168.255.2**01**
-	-	OFF	OFF	OFF	OFF	ON	OFF	192.168.255.2**02**
								:
-	-	ON	ON	OFF	ON	ON	OFF	192.168.255.2**54**
-	-	ON	ON	OFF	ON	ON	ON	192.168.255.2**55**

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.

The following IP address is set via the DIP switch on delivery:
- IP address: 192.168.255.210
- Subnet mask: 255.255.255.0
- Default gateway: 0.0.0.0

Configuring the Robot Interface

1 Set the DIP switch in accordance with the desired configuration

NOTE!

Risk due to invalid DIP switch settings.
This may result in malfunctions.
- ▶ Whenever changes are made to the DIP switch settings, the interface must be re-started. This is the only way for the changes to take effect.
- ▶ Restart the interface = interrupting and restoring the power supply or executing the relevant function on the website of the power source (SmartManager).

Installing the Robot Interface

Safety

⚠ WARNING!

Electrical current hazard.
This can result in serious injuries or death.

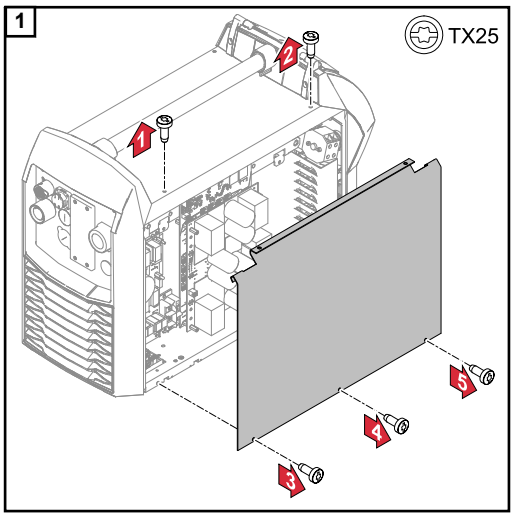
- ▶ Before starting work, switch off all the devices and components involved and disconnect them from the grid.
- ▶ Secure all the devices and components involved to prevent unintentional restarting.
- ▶ After opening the device, use a suitable measuring instrument to check that electrically charged components (such as capacitors) have been discharged.

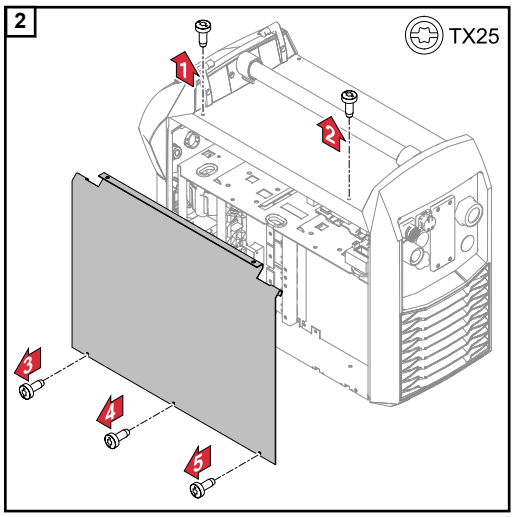
⚠ WARNING!

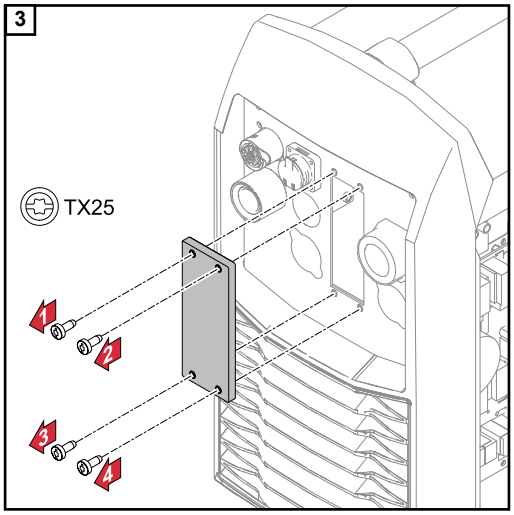
Electrical current hazard caused by an inadequate ground conductor connection.
This can result in severe personal injury and damage to property.

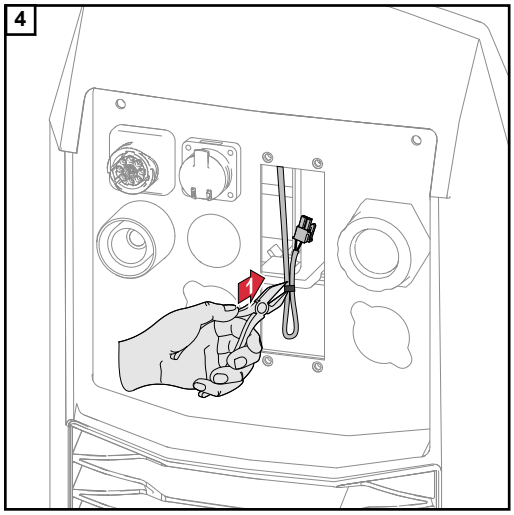
- ▶ Always use the original housing screws in the original quantity.

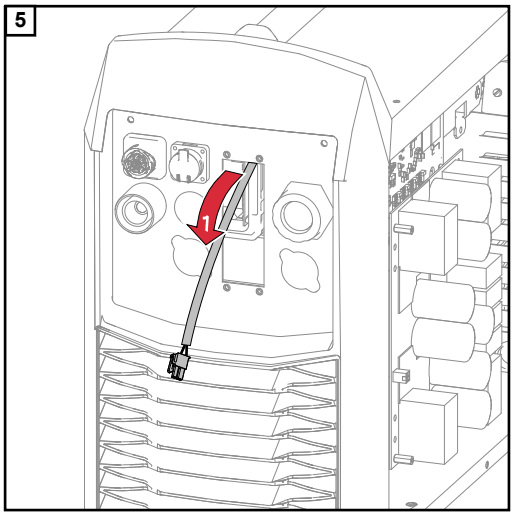
Preparation



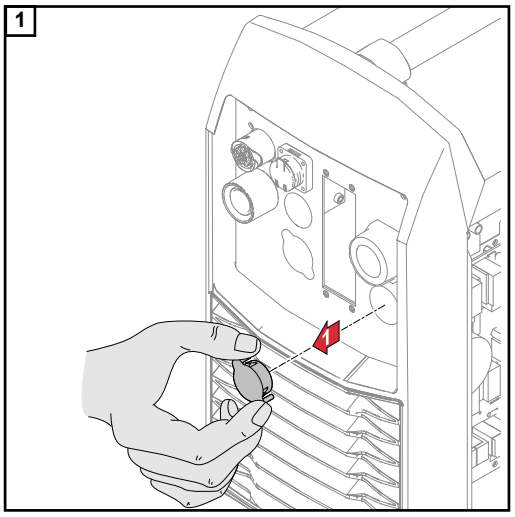


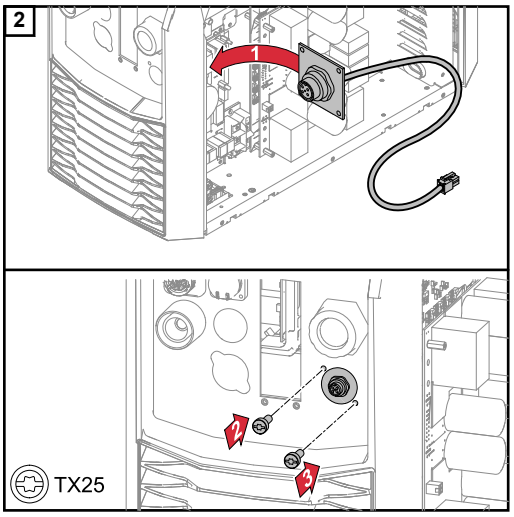


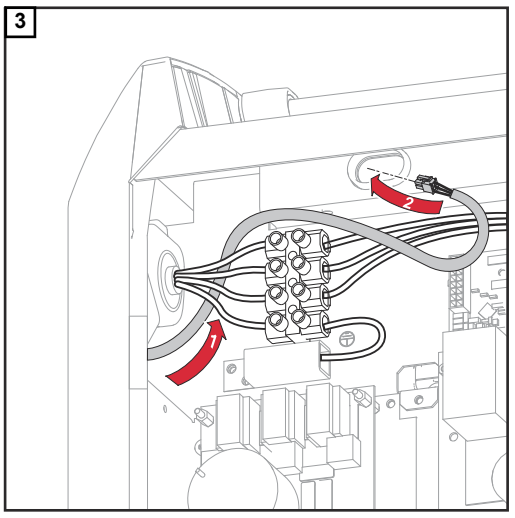


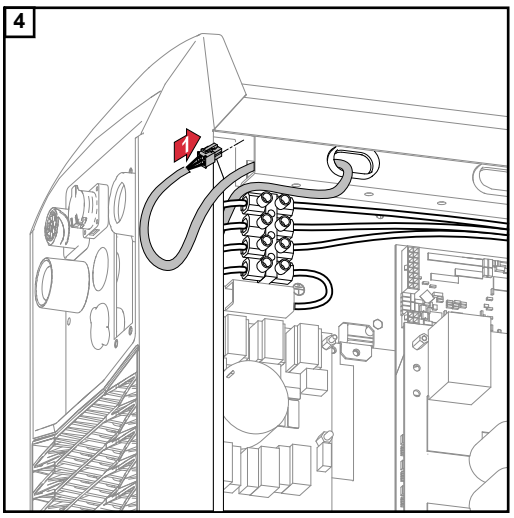


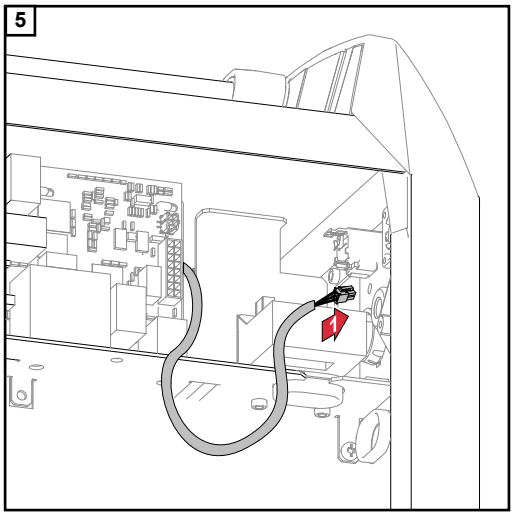
Fitting the M12 Connection

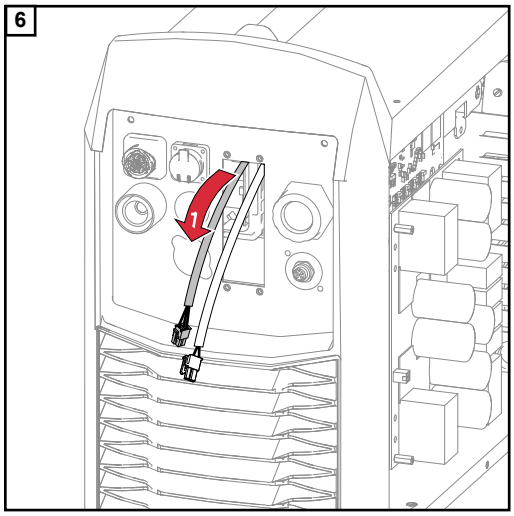




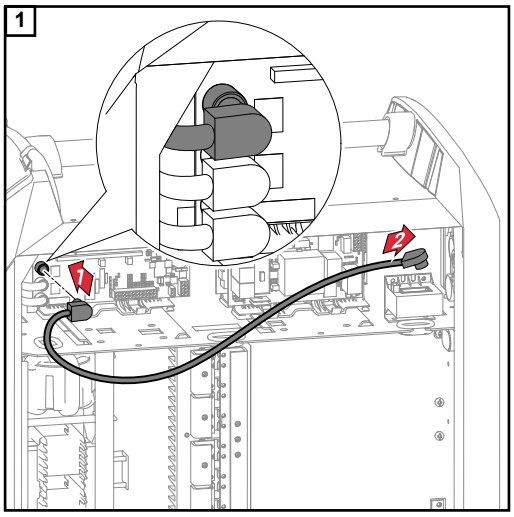


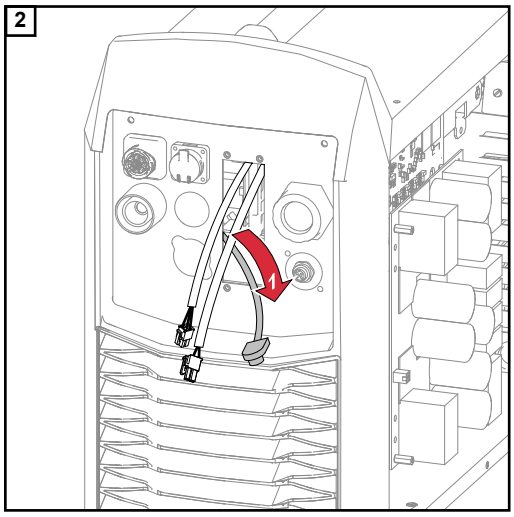


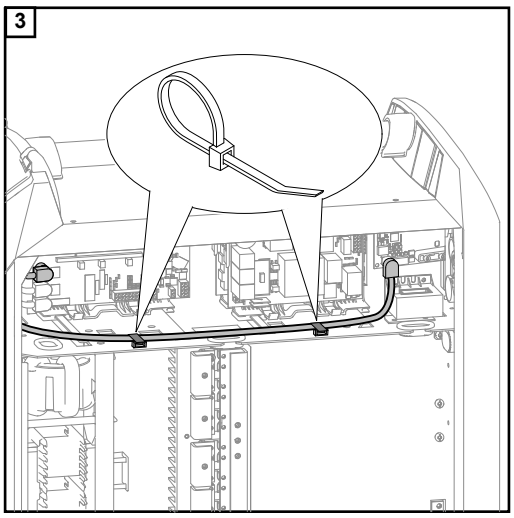




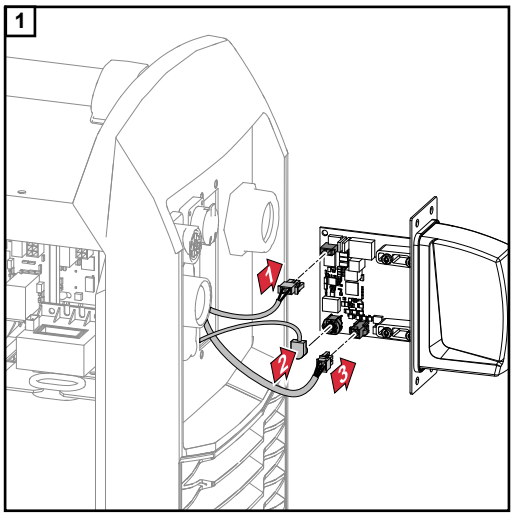
Routing the Data Cable

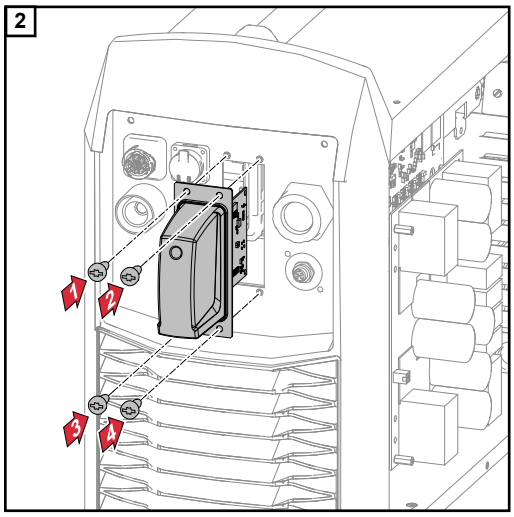




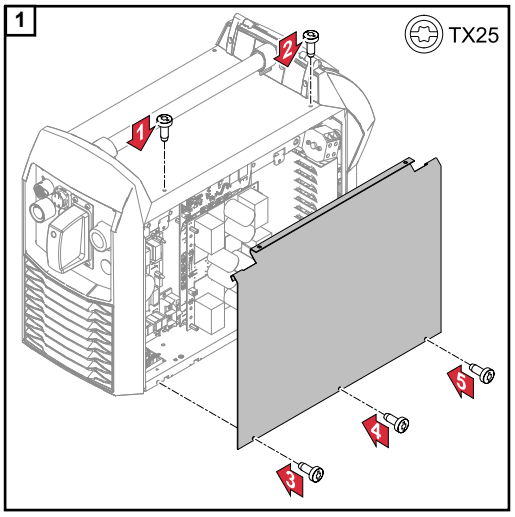


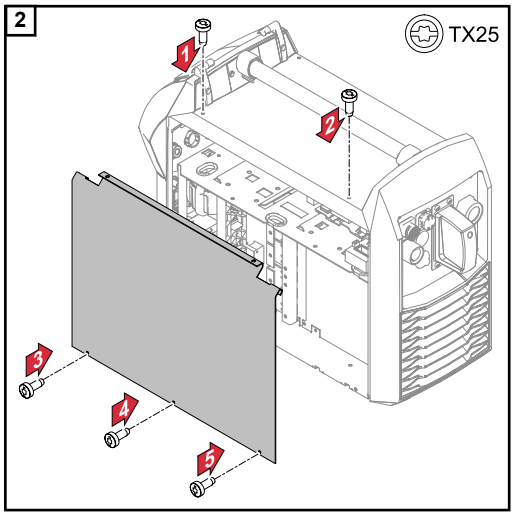
Installing the Robot Interface





Final Tasks





Installing the Bus Module

Safety

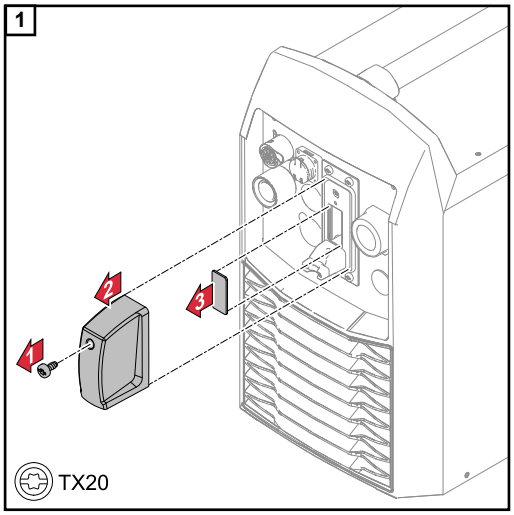
⚠ WARNING!

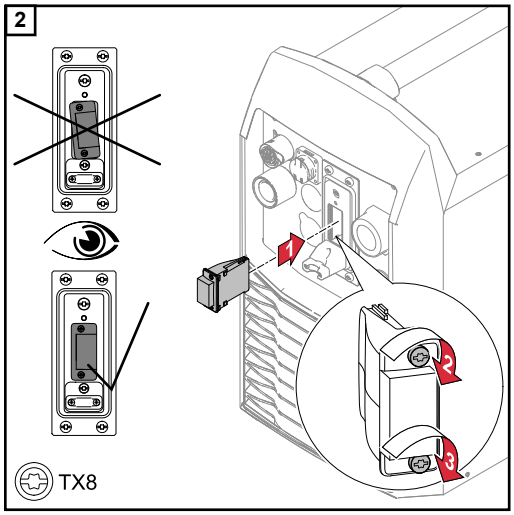
Danger from electrical current.
Serious injuries or death may result.
- ▶ Before starting work, switch off all devices and components involved, and disconnect them from the grid.
- ▶ Secure all devices and components involved so that they cannot be switched back on.

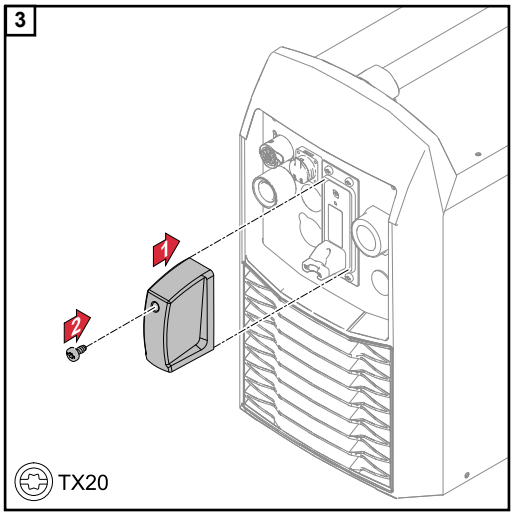
⚠ WARNING!

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

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 V2.3.0 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 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	Reserved			
	Bit 10	SFI ON	Boolean		
	Bit 11	Synchro pulse on	Boolean		
	Bit 12	WireBrake	Boolean		
	Bit 13	Torch XChange	Boolean		
	Bit 14	TeachMode	Boolean		
	Bit 15	Reserved			

HEX Address	Signal		Type	Range / Unit	Factor
F002	Control Flag Group 3				
	Bit 0	Process line selection Bit 0	Boolean	See section **Value range Process line selection** on page **25**	
	Bit 1	Process line selection Bit 1	Boolean		
	Bit 2	TWIN mode Bit 0	Boolean	See section **Value Range for TWIN Mode** on page **25**	
	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 section **Value Range for Documentation mode** on page **26**	
	Bits 1 to 15	Reserved			
F004	Control Flag Group 5				
	Bits 0 to 15	Reserved			
F005	Control Flag Group 6				
	Bits 0 to 15	Reserved			
F006	Control Flag Group 7				
	Bits 0 to 15	Reserved			

HEX Address	Signal		Type	Range / Unit	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 to 15	Reserved			
F008	Working mode			See section **Value range Working mode** on page **26**	
	Bit 0	Working Mode Bit 0			
	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 to 13	Reserved			
	Bit 14	Command value selection	Boolean	See section **Value Range for Command value selection** on page **26**	
	Bit 15	Reserved			
F009	Job number		UINT16	0 to 1000	
F00A	Program number (xml-file)		UINT16	0 to 65,535	
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

HEX Address	Signal	Type	Range / Unit	Factor
F00F	Welding speed	UINT16	0 to 65,535 (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			
F017	Reserved			
F018	Reserved			
F019	Reserved			
F01A	Wire forward / backward length	UINT16	OFF / 1 to 65,535 mm	1
F01B	Wire sense edge detection	UINT16	OFF / 0.5 to 20.0 mm	10
F01C	Reserved			
F01D	Seam number	UINT16	0 to 65,535	1

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 Working mode

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	Internal 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

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 V2.3.0 and higher

HEX Address	Signal		Type	Range / Unit	Factor
F100	Status Flag Group 1				
	Bit 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	Touched	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 section **Value Range for Welding Process and Process Image** on page **30**	
	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		
	Bit 5 = 7	Reserved			
	Bit 8	Parameter selection internally	Boolean		
	Bit 9	Characteristic number valid	Boolean		
	Bit 10 = 13	Reserved			
	Bit 14	Process image Bit 0	Boolean		
	Bit 15	Process image Bit 1	Boolean		

HEX Address	Signal		Type	Range / Unit	Factor
F103	Status Flag Group 4				
	Bit 0	Penetration stabilizier	Boolean		
	Bit 1	Arclength stabilizier	Boolean		
	Bit 2 = 15	Reserved			
F104	Status Flag Group 5				
	Bit 0	Sensor status 1 High	Boolean	See section **Assignment of Sensor Statuses 1–3** on page **30**	
	Bit 1	Sensor status 2 High	Boolean		
	Bit 2	Sensor status 3 High	Boolean		
	Bit 3 = 10	Reserved			
	Bit 11	Safety status Bit 0	Boolean	See section **Value range Safety status** on page **30**	
	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		
	Bit 1 = 7	Reserved			
	Bit 8	Reserved			
	Bit 9	TWIN synchronization active	Boolean		
	Bit 10	Line supply status	Boolean		
	Bit 11 = 13	Reserved			
	Bit 14	Warning	Boolean		
	Bit 15	Reserved			
F106	Status Flag Group 7				
	Bit 0 = 15	Reserved	Boolean		

HEX Address	Signal		Type	Range / Unit	Factor
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		
	Bit 8 = 15	Reserved	Boolean		
F108	Main error number		UINT16	0 to 65,535	
F109	Warning number		UINT16	0 to 65,535	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 kilojoules	10
F113	Wire position		SINT16	-327.68 to 327.67 mm	100
F114	Reserved				
F115	Reserved				

HEX Address	Signal	Type	Range / Unit	Factor
F116	Reserved			
F117	Reserved			
F118	Reserved			
F119	Reserved			
F11A	Reserved			
F11B	Reserved			
F11C	Reserved			
F11D	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	Bit 0-13	Description
0	0	-	Standard image (Weldcom V2.0)
1	0	-	Retrofit image (Weldcom TPS series)

Value range for process image

Assignment of Sensor Statuses 1–3

Bit 2	Bit 1	Bit 0	Description
0	0	1	OPT/i WF R wire end
0	1	0	OPT/i WF R DE wire drum
1	0	0	OPT/i WF R DE ring sensor

Value range Safety status

Bit 1	Bit 0	Description
0	0	Reserve
0	1	Hold

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

TAG Table

- To read the following TAGs, use the mode function 03dec (03hex) - see section **03_{dec} (03_{hex}) Read Holding Register** from page **42**
- To edit the following TAGs, use the mode function 06dec (06hex) - see section **06_{dec} (06_{hex}) Write Single Register** from page **43**

HEX address	Description	Reading / writing	Unit	Type	Step size
E064	Gas preflow [Gpr]	Reading & writing	s	Word	0.1
E065	Gas postflow [Gpo]	Reading & writing	s	Word	0.1
E098	Error number	Read only			1
E062	Min. feeder value	Read only	m/min	Word	0.1
E063	Max. feeder value	Read only	m/min	Word	0.1
E0A3	Inching speed [Fdi]	Reading & writing	m/min	Word	0.1
E032	SynchroPulse DeltaWireFeed	Reading & writing	m/min	Word	
E031	SynchroPulse Frequency	Reading & writing	Hz	Word	0.1
E033	SynchroPulse DutyCycle	Reading & writing	%	Word	1
E034	SynchroPulse ArcLength Correction High	Reading & writing			0.1
E035	SynchroPulse ArcLength Correction Low	Reading & writing			0.1
E06A	Starting current [I-S]	Reading & writing	%	Word	1
E06B	Slope 1	Reading & writing	s	Word	0.1
E06C	Slope 2	Reading & writing	s	Word	0.1
E06D	End current [I-E]	Reading & writing	%	Word	1
E056	Starting Current Time [t-S]	Reading & writing	s	Word	0.1 OFF=12e34
E057	End Current Time [t-e]	Reading & writing	s	Word	0.1 OFF=12e34
E02E	SFI HotStart	Reading & writing	s	Word	0.01

HEX address	Description	Reading / writing	Unit	Type	Step size
E06F	Language	Reading & writing	Con-stant	Float	
	Name: Language				
	Constant: English (8e34)				
	Constant: German (9e34)				
	Constant: Chinese (10e34)				
	Constant: Spanish (23e34)				
	Constant: French (24e34)				
	Constant: Czech (25e34)				
	Constant: Hungarian (26e34)				
	Constant: Italian (27e34)				
	Constant: Norwegian (28e34)				
	Constant: Polish (29e34)				
	Constant: Portuguese (30e34)				
	Constant: Slovak (31e34)				
	Constant: Turkish (32e34)				
	Constant: Russian (33e34)				
	Constant: Swedish (34e34)				
	Constant: Estonian (35e34)				
	Constant: Finnish (36e34)				
	Constant: Lithuanian (39e34)				
	Constant: Latvian (40e34)				
	Constant: Dutch (41e34)				
	Constant: Slovenian (42e34)				
	Constant: Romanian (43e34)				
	Constant: Croatian (44e34)				
	Constant: Japanese (58e34)				
	Constant: Ukrainian (59e34)				
	Constant: Korean (61e34)				
	Constant: Icelandic (66e34)				
	Constant: Vietnamese (67e34)				
	Constant: Thai (70e34)				
	Constant: Indonesian (71e34)				
	Constant: Serbian (75e34)				
	Constant: Hindi (76e34)				
	Constant: Tamil (130e34)				
	Constant: Danish (151e34)				
	Constant: Bulgarian (156e34)				
E0A6	Hourmeter Current flow	Read only	h	Float	0.1
E0A7	Hourmeter Power on	Read only	h	Float	0.1

HEX address	Description	Reading / writing	Unit	Type	Step size
E0AA	Power value	Read only	kW	Float	0.1
E0AB	Real energy value	Read only	kJ	Float	0.1
E0BB	Coolertemperature	Read only	C	Float	0.1
E0BC	Coolerflow	Read only	l/min	Float	0.01

Retrofit Image Input and Output Signals

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			
F006	Control Flag Group 7				
	Bits 0 to 15	Reserved			
F007	Control Flag Group 8				
	Bits 0 to 15	Reserved			

HEX address	Signal		Type	Range / Unit	Factor
F008	Operating mode			See table **Value Range for Operating Mode** on page **35**	
	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

Bit 4-15	Bit 3	Bit 2	Bit 1	Bit 0	Description
-	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 65535 (0 to 100 V)	
F10B	Welding current actual value		Word	0 to 65535 (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 **42**
- 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 **43** / section **16_{dec} (10_{hex}) Write Multiple Register** from page **43**

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

HEX address	Description	Reading / writing	Unit	Type	Step size
E01F	Slope 1 + Slope 2	Reading / writing	s	Word	0.001
E020	End current [I-E]	Reading / writing	%	Word	0.1
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
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
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
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

Example Example request for reading 2 registers and writing 2 registers.			
Request		**Response**	
Field name	**Hex**	**Field name**	**Hex**
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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