Fronius RI FB Inside CC-M40 EtherCAT The Bus Module Instruction Manual

Operating
Instructions

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RI FB Inside/i
RI MOD/i CC-M40 EtherCAT

Operating instructions

42,0410,1915 034-17072024

General

Safety

WARNING!

Incorrect operation and faulty work can cause serious personal injury and material damage.
All work and functions described in this document must be performed only by trained specialist personnel who have read and understood the following documents in full:
▶ this document
▶ the Operating Instructions of the robot interface “RI FB Inside/i”
▶ all documents relating to system components, especially the safety rules

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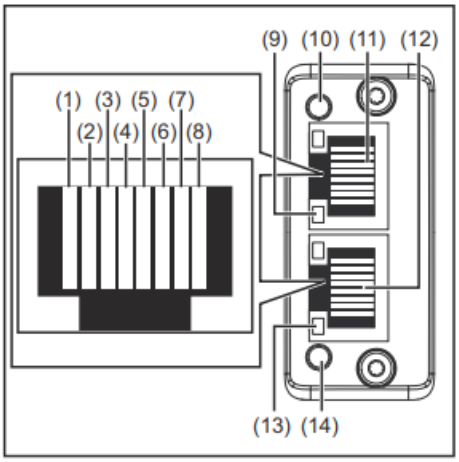
Connections and Indicators



(1)	TX+
(2)	TX-
(3)	RX+
(6)	RX-
(4), (5)	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).
(7), (8)	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).
(9)	Connection/Activity LED – EtherCATоutput
(10)	ERR LED (error)
(11)	EtherCATоutput
(12)	EtherCATinput
(13)	Connection/Activity LED – EtherCATinput
(14)	RUN LED (operation)

RUN LED (operation) **This indicates the status of the CoE communication.** **(CoE = CANopen over EtherCAT)**	
Status	**Meaning**
Off	EtherCAT device in ‘init’ status (or no supply voltage)
Lights up green	EtherCAT device in ‘operational’ status
Flashes green	EtherCAT device in ‘pre-operational’ status
Flashes green (briefly)	EtherCAT device in ‘safe-operational’ status
Lights up red	If the Run LED and Error LED light up red, this indicates a serious event which places the interface in an exception state. ⇨ Contact the service team

ERR LED (error)	
Status	**Meaning**
Off	No error (or no supply voltage)
Flashes red	Incorrect configuration The status change received from the master is not possible due to invalid register or object settings.
Flashes red (twice)	Application watchdog timeout Sync manager watchdog timeout
Lights up red	Application controller failure Anybus module in EXCEPTION

Connection/Activity LED	
Status	**Meaning**
Off	No connection (or no supply voltage)
Lights up green	Connection detected, no activity
Flickers green	Connection detected, activity present

Data Transfer Properties

Transfer technology: EtherCAT
Medium: When selecting the cable, plug, and terminating resistors, the IEC 61784-5-12 for the planning and installation o f EtherCAT systems must be observed.The EMC tests were carried out by the manufacturer with an original Bec khoff cable (ZK1090-9191-xxxx).
Transmission speed: 100 Mbit/s
Bus connection: RJ45 Ethernet
Application layer: CANopen

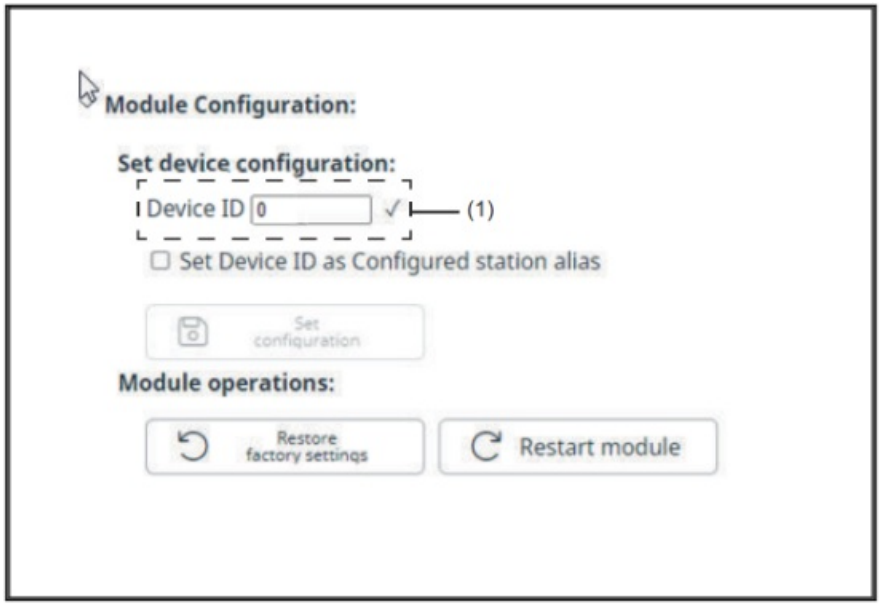
Configuration Parameters

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	Description
Vendor ID	0000 $02C1_{hex}$ (705_{dec})	Fronius International GmbH
Product Code	0001 0301_{hex} (66305_{dec}) 0001 0302_{hex} (66306_{dec}) 0001 0303_{hex} (66307_{dec})	Economy image Standard image Retrofit image
Device name		Fronius-FB-Inside-EtherCAT

Hot-Connect application

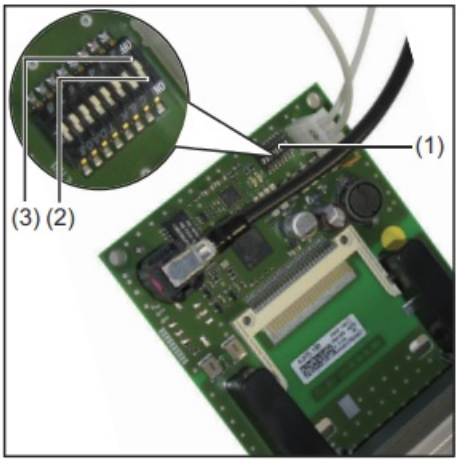
The master uses a device ID to uniquely identify a slave. Changing a defective device during operation is called a hot connect application. A preconfigured device can then be added to the network and its device ID can be assigned the same device ID that was used to name the defective device. If there are two or more identical devices in the network, this can prevent cables from being swapped.



(1) Enter device ID

Configuration of robot interface

Dip switch function



The dip switch (1) on the RI FB Inside/i robot interface is used to configure the process data width.

At the factory all positions of the (1) dipswitch are set to OFF (3).
This corresponds to the binary value 0.

The position (2) corresponds to the binary value 1.

Configuration of the process data width

Dip switch								Configuration
8	7	6	5	4	3	2	1	
OFF	OFF	–	–	–	–	–	–	Standard image 320 Bit
OFF	ON	–	–	–	–	–	–	Economy image 128 Bit
ON	OFF	–	–	–	–	–	–	Retro Fit Scope dependent on bus module
ON	ON	–	–	–	–	–	–	Not used

The process data width defines the scope of the transferred data volume.

The kind of data volume that can be transferred depends on
– the robot controls
– the number of welding machines
– the type of welding machines

– “Intelligent Revolution”
– “Digital Revolution” (Retro Fit)

Configuring the Node Address

The EtherCAT address is assigned by the master.

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} = $FFC0_{hex}$

Availability of Input Signals

The input signals listed below are available from firmware V4.1.x for all Inside/i systems.

Input signals (from robot to power source)

Address				Signal	Activity / data type	Range	Factor	Process image	
Relative			Absolute					Standard	Economy
WORD	BYTE	BIT	BIT						
0	0	0	0	Welding Start	Increasing			✓	✓
		1	1	Robot ready	High				
		2	2	Working mode Bit 0	High	See table **Value Range for Working Mode** on page **36**			
		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	Increasing				
		1	9	Wire forward	Increasing				
		2	10	Wire backward	Increasing				
		3	11	Error quit	Increasing				
		4	12	Touch sensing	High				
		5	13	Torch blow out	Increasing				
		6	14	Processline selection Bit 0	High	See table **Value range Process line selection** on page **37**			
		7	15	Processline selection Bit 1	High				
		0	16	Welding simulation	High				

1	2	1	17	Welding process MIG/MAG: [1] Synchro pulse on	High				
				Welding process WIG: [2] TAC on	High				
		2	18	Welding process WIG: [2] Cap shaping	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	—					
		3	27	—					
		4	28	—					
		5	29	Wire sense start	Increasing				
		6	30	Wire sense break	Increasing				
		7	31	—					
2	4	0	32	TWIN mode Bit 0	High	See table **Value Range for TWIN Mode** on page **37**			
		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 **37**			
		6	38	—					
		7	39	—					
		0	40	—				✓	✓
		1	41	—					
		2	42	—					

	5	3	43	—					
		4	44	—					
		5	45	—					
		6	46	—					
		7	47	Disable process controlled correction	High				
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	8-9	0-7	64–79	Welding characteristic- / Job number	UINT16	0 to 1000	1	✓	✓
	10-	0	80-	Welding process MIG/MAG: [1)] Constant Wire: Wire feed speed command value	SINT16	-327,68 to 327,67 [m/min]	100		

5	11	-7	95	Welding process WIG: [2)] Main- / Hotwire current command value	UINT16	0 to 6553,5 [A]	10	✓	✓
				For job-mode: Power correction	SINT16	-20,00 to 20,00 [%]	100		
6	12-13	0-7	96-111	Welding process MIG/MAG: [1)] Arclength correction	SINT16	-10,0 to 10,0 [Schritte]	10	✓	✓
				Welding process MIG/MAG Standard-Manuel: Welding voltage	UINT16	0,0 to 6553,5 [V]	10		
				Welding process WIG: [2)] Wire feed speed command value	SINT16	-327,68 to 327,67 [m/min]	100		
				For job-mode: Arclength correction	SINT16	-10,0 to 10,0 [Schritte]	10		
				Welding process Constant Wire: Hotwire current	UINT16	0,0 to 6553,5 [A]	10		
7	14-15	0-7	112-127	Welding process MIG/MAG: [1)] Pulse-/dynamic correction	SINT16	-10,0 to 10,0 [steps]	10	✓	✓
				Welding process MIG/MAG Standard-Manuel: Dynamic	UINT16	0,0 to 10,0 [steps]	10		
				Welding process WIG: [2)] Wire correction	SINT16	-10,0 to 10,0 [steps]	10		
8	16-17	0-7	128-143	Welding process MIG/MAG: [1)] Wire retract correction	UINT16	0,0 to 10,0 [steps]	10	ü	

				Welding process WIG: [2] Wire retract end	UINT16	OFF, 1 to 50 [mm]	1		
9	18-19	0-7	144-159	Welding speed	UINT16	0,0 to 1000,0 [cm/min]	10	✓	
10	20-21	0-7	160-175	Process controlled correction		See table **Value range for Process controlled correction** on page **37**		✓	
11	22-23	0-7	176-191	Welding process WIG: [2] Wire positioning start				✓	
12	24-25	0-7	192-207	—				✓	
13	26-27	0-7	208-223	—				✓	
14	28-29	0-7	224-239	—				✓	
15	30-31	0-7	240-255	Wire forward / backward length	UINT16	OFF / 1 to 65535 [mm]	1	✓	
16	32-33	0-7	256-271	Wire sense edge detection	UINT16	OFF / 0,5 to 20,0 [mm]	10	✓	
17	34-35	0-7	272-287	—				✓	
18	36-37	0-7	288-303	—				✓	
19	38-39	0-7	304-319	Seam number	UINT16	0 to 65535	1	✓	

1) MIG/MAG Puls-Synergic, MIG/MAG Standard-Synergic, MIG/MAG Standard-Manuel, MIG/MAG PMC,

MIG/MAG, LSC
2) WIG coldwire, WIG hotwire

Value Range for 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
0	1	0	0	1	2-step MIG/MAG standard manual
1	0	0	0	0	Idle Mode
1	0	0	0	1	Stop coolant pump
1	1	0	0	1	R/L-Measurement

Value range for operating mode

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 welding machine (internal)
1	Seam number of robot (Word 19)

Value range for documentation mode

Value range for Process controlled correction

Process	Signal	Activity / data type	Value range configuration range	Unit	Factor
PMC	Arc length stabilizer	SINT16	-327.8 to +327.7 0.0 to +5.0	Volts	10

Value range for process-dependent correction

Availability of Output Signals

The output signals listed below are available from firmware V4.1.x for all Inside/i systems.

Output Signals (from Power Source to Robot)

Address					Process image

Relative			Absolute	Signal	Activity / data type	Range	Factor	Standard	Economy
WORD	BYTE	BIT	BIT						
0	0	0	0	Heartbeat Powersource	High/Low	1 Hz		✓	✓
		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	High	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				
1	2	0	16	Command value out of range	High			✓	✓
		1	17	Correction out of range	High				
		2	18	—					
		3	19	Limitsignal	High				
		4	20	—					
		5	21	—					
		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 **41**		
		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	—				✓
		1	33	—				
		2	34	—				
		3	35	Safety status Bit 0	High	See table **Value range Safety status** on page page **42**		
		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	—				
	6	0	48	Process Bit 0	High	See table **Value Range for Process Bit** on page **42**		
		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	Touch signal gas nozzle	High			
		7	55	TWIN synchronization active	High			

3	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	8-9	0-7	64-79	Welding voltage	UINT16	0.0 to 655.35 [V]	100	✓	✓
5	10-11	0-7	80-95	Welding current	UINT16	0.0 to 6553.5 [A]	10	✓	✓
6	12-13	0-7	96-111	Wire feed speed	SINT16	-327.68 to 327.67 [m/ min]	100	✓	✓
7	14-15	0-7	112-127	Actual real value for seam tracking	UINT16	0 to 6.5535	10000	✓	✓
8	16-17	0-7	128-143	Error number	UINT16	0 to 65535	1	✓	
9	18-19	0-7	144-159	Warning number	UINT16	0 to 65535	1	✓	
10	20-21	0-7	160-175	Motor current M1	SINT16	-327.68 to 327.67 [A]	100	✓	
11	22-23	0-7	176-191	Motor current M2	SINT16	-327.68 to 327.67 [A]	100	✓	
12	24-25	0-7	192-207	Motor current M3	SINT16	-327.68 to 327.67 [A]	100	✓	

13	26-27	0-7	208-223	—				✓	
14	28-29	0-7	224-239	—				✓	
15	30-31	0-7	240-255	—				✓	
16	32-33	0-7	256-271	Wire position	SINT16	-327.68 to 327.67 [mm]	100	✓	
17	34-35	0-7	272-287	—				✓	
18	36-37	0-7	288-303	—				✓	
19	38-39	0-7	304-319	—				✓	

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)

Assignment of sensor statuses

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 Safety status

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
0	1	0	1	0	ColdWire
0	1	0	1	1	DynamicWire

Value Range for Process Bit

Value Range for Function status

Bit 1	Bit 0	Description
0	0	Inactive
0	1	Idle
1	0	Finished
1	1	Error

Input Signals

The signals listed below are available from firmware V1.6.0 for all Inside/i systems.

Serial no.	Signal designation	Range	Action
E01	Welding on		High
E02	Robot ready		High
E03	Operating mode bit 0	See table **Value range for operating modes** on page **44**	High
E04	Operating mode bit 1		High
E05	Operating mode bit 2		High
E06	—		
E07	—		
E08	—		
E09	Gas test		High
E10	Wire forward		High
E11	Wire backward		High
E12	Error quit		High
E13	Position search		High
E14	Purge welding torch		High
E15	—		
E16	—		
E17 – E24	Job number	0 to 99	
E25 – E31	Program number	1 to 127	
E32	Welding simulation		High
Only in Job mode (E17 – E32):			
E17 – E31	Job number	0 to 999	
E32	Welding simulation		High
E33 – E40	Output set value – Low byte	0 to 65535 (0 to 100%)	
E41 – E48	Output set value – High byte		

E49 – E56	Arc length correction, set value Low byte	0 to 65535 (-30 to +30%)	
E57 – E64	Arc length correction, set value High byte		
E65 – E72	Pulse or dynamic correction	0 to 255 (-5 to +5%)	
E73 – E80	—		
E81 – E88	—		
E89 – E96	—		
E97 – E104	Welding speed – Low byte	0 to 65535 (0 to 6553.5 cm/min)	
E105 – E112	Welding speed – High byte		
E113	SynchroPulse on		High
E114	—		
E115	—		
E116	—		
E117	Output full range (0 to 30 m)		High
E118	—		
E119	—		
E120	—		
E121 – E128	—		
E129 – E296	—		

Value range for operating modes

Bit 2	Bit 1	Bit 0	Description
0	0	0	MIG/MAG Synergic welding
0	0	1	MIG/MAG Synergic welding
0	1	0	Job mode
0	1	1	Internal parameter selection

Output Signals

The signals listed below are available from firmware V1.6.0 for all Inside/i systems.

Seq. no	Signal designation	Range	Action
A01	Arc stable		High
A02	Limit signal		High
A03	Process active		High
A04	Main current signal		High
A05	Welding torch collision protection		High
A06	Power source ready		High
A07	Communication ready		High
A08	Life Cycle Toggle Bit (250ms)		High
A09 – A16	—		
A17 – A24	—		
A25	—		
A26	—		
A27	—		
A28	Wire present		
A29	Short circuit time exceeded		High
A30	—		
A31	—		
A32	Power out of range		High
A33 – A40	Welding voltage actual value – Low byte	0 to 65535 (0 to 100 V)	
A41 – A48	Welding voltage actual value – High byte		
A49 – A56	Welding current actual value – Low byte	0 to 65535 (0 to 1000 A)	
A57 – A64	Welding current actual value – High byte		
A65 – A72	Motor current	0 to 255 (0 to 5 A)	
A73 – A80	—		
A81 – A88	—		
A89 – A96	—		
A97 – A104	Wire speed – Low byte	0 to vDmax	
A105 – A112	Wire speed – High byte		
A113 – A120	—		
A121 – A128	—		
A129 – A296	—		

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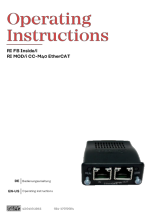
Documents / Resources

	Fronius RI FB Inside CC-M40 EtherCAT The Bus Module [pdf] Instruction Manual 42, 0410, 1915, RI FB Inside CC-M40 EtherCAT The Bus Module, RI FB, Inside CC-M40 Ether CAT The Bus Module, EtherCAT The Bus Module, Bus Module, Module

References

- Fronius Spare Parts
- User Manual