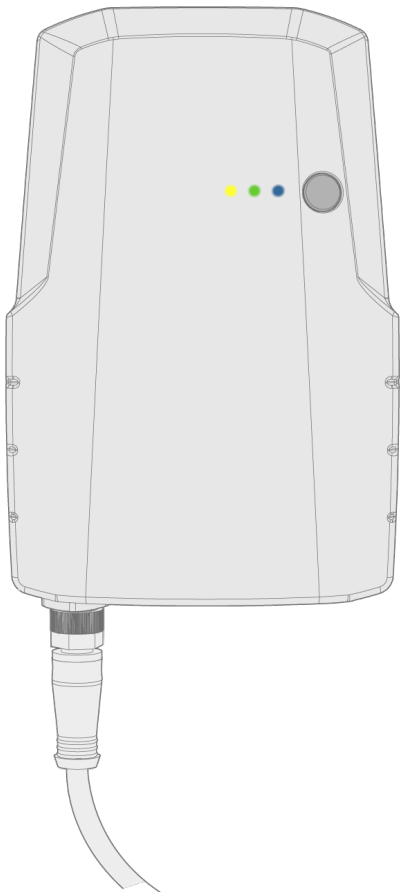
DIGITAL CONNECTIVITY MODULE (DCM) / KEMPPI COBOTICS



Operating manual

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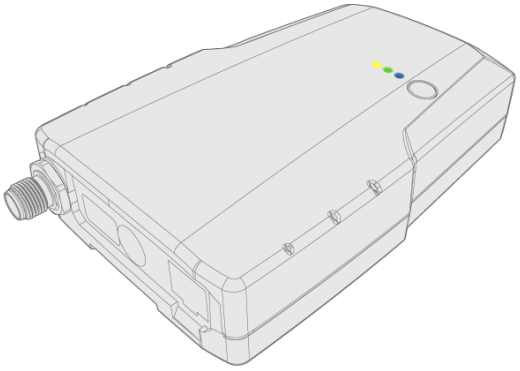
1. GENERAL



Kemppi's Digital Connectivity Module (DCM) is a small single-board computer connected directly to the welding power source or wire feeder. Together with the Kemppi Cobotics application, it forms a connection between the welding equipment and robot / cobot (collaborative robot) via the Modbus TCP fieldbus (in the setup, DCM is a Modbus TCP slave device).

DCM uses wireless Bluetooth technology for communicating with the mobile device.

DCM for Cobotics is compatible with the following Kemppi welding equipment:

- X5 FastMig (Auto, AP and APC equipment)
  >> Firmware version: 1.46 or later

DCM does not support a double wire feeder configuration.

- Master M 358
  >> Firmware version: 1.12 or later
- Master M 353, 355
  >> Firmware version: 1.12 or later

If you want to use an Ethernet/IP connection instead of a Modbus TCP fieldbus connection, we recommend using a fieldbus converter (Modbus TCP into Ethernet/IP) available with pre-configured settings. For more information, refer to "Connecting fieldbus converter (optional)" on page 12.

Important notes

Read the instructions through carefully. For your own safety, and that of your working environment, pay particular attention to the safety instructions delivered with the equipment.

Items in the manual that require particular attention in order to minimize damage and harm are indicated with the below symbols. Read these sections carefully and follow their instructions.

Note: Gives the user a useful piece of information.

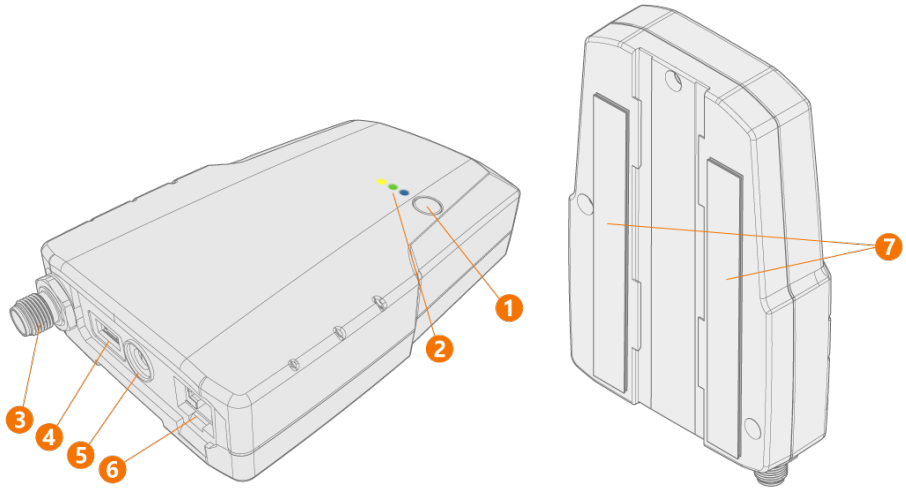
Caution: Describes a situation that may result in damage to the equipment or system.

Warning: Describes a potentially dangerous situation. If not avoided, it will result in personal damage or fatal injury.

DISCLAIMER

While every effort has been made to ensure that the information contained in this guide is accurate and complete, no liability can be accepted for any errors or omissions. Kemppi reserves the right to change the specification of the product described at any time without prior notice. Do not copy, record, reproduce or transmit the contents of this guide without prior permission from Kemppi.

1.1 EQUIPMENT DESCRIPTION



1. Function button
2. 3 LED indicators
3. CAN connection (5-pin, M12 bus connector)
4. USB connector *
5. Power connector *
6. Ethernet connector
7. Mounting tape.

** Not needed for normal operation. DCM is powered through the CAN connection.*

LEDs explained

a. Red / yellow / green: Additional notification light. (A)
b. Green: Lit when the power is on. (B)
c. Blue: Blinks infrequently when ready and available, blinks more frequently when in "beacon mode", is lit continuously when a mobile device with the Kemppi Cobotics App is connected. (C)

Additional requirements

- Mobile device with wireless connection support running Android 7.1 or newer (Android 8.0 is recommended) and Kemppi Cobotics application
- Internet connection available for the mobile device running the Kemppi Cobotics application.

EQUIPMENT IDENTIFICATION

Serial number

Serial number of the device is marked on the rating plate or in another distinctive location on the device.

Quick Response (QR) code

The serial number and other device-related identification information may also be saved in the form of a QR code (or a barcode) on the device. Such code can be read by a smartphone camera or with a dedicated code reader device providing fast access to the device-specific information.

2. INSTALLATION

⚠ *Do not power on the equipment before the installation is complete.*

Before installation

Check the contents of the packages and make sure the parts are not damaged.

"Mounting on equipment" on the next page

"Connecting cables" on page 10

"Installing Kemppi Cobotics application" on page 11

"Connecting fieldbus converter (optional)" on page 12

2.1 MOUNTING ON EQUIPMENT

The DCM device can be fixed on the side of a power source or a wire feeder either with the factory-fitted mounting tape or with an optional DIN rail.

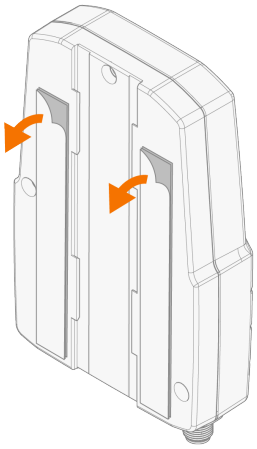
The mounting tape can be used on any clean and suitable surface. The mounting tape counterparts are attached together on delivery.

Do not detach the mounting tape counterpart from the DCM device before fixing. This way the mounting tape counterparts are positioned correctly on the installation surface.

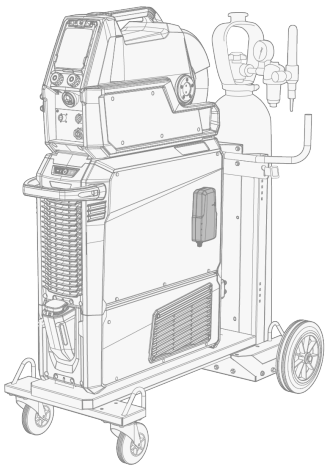
Install the DCM device the connectors facing down. This also prevents e.g. dust and impurities from getting into the connectors.

Fixing with mounting tape

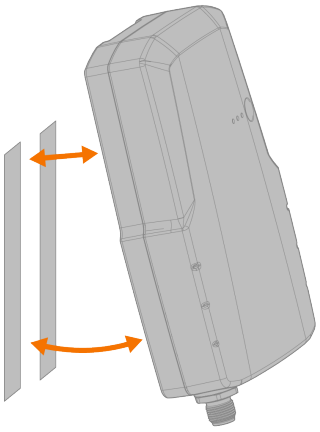
1. Clean the installation surface (where the DCM device is to be fixed).
2. Remove the cover wrappings from the mounting tape counterpart to reveal the adhesive surface. Leave the mounting tape counterparts still attached.



3. Press the DCM device firmly against the installation surface so that the glue sticks.



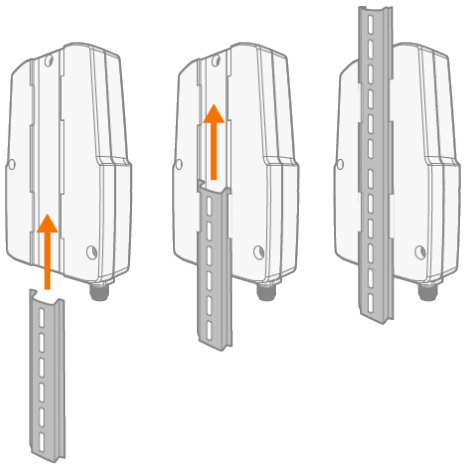
4. Let the mounting tape's adhesive cure for 30 minutes.
5. Due to the velcro-type mounting tapes, it is now possible to detach and attach the DCM device if needed.



Mounting on DIN rail (optional)

Note that the rail installation typically requires drilling fixing holes on the fixing surface for the rail itself. This is not covered by this instruction.

The rear of the DCM box has a groove for the standard DIN rail fixing:



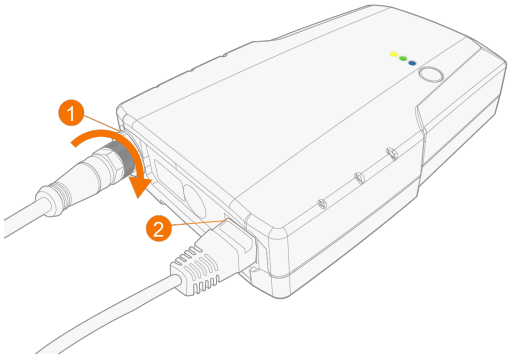
2.2 CONNECTING CABLES

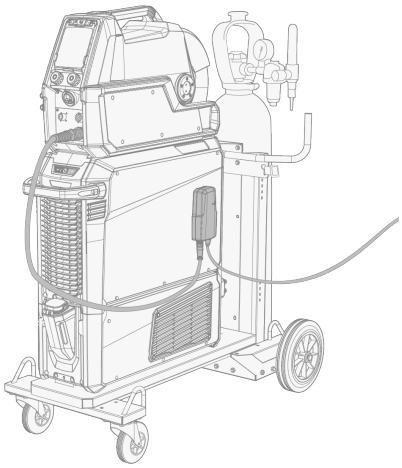
The DCM requires a CAN and an Ethernet cable to be connected.

It is recommended to use a shielded Ethernet cable (minimum F/UTP – foil shielded / unshielded twisted pair).

Unused DCM connectors are covered. Leave the covers in place.

1. Connect the CAN cable to the power source or wire feeder.
2. Connect the other end of the CAN cable to the DCM (1). Secure the cable by turning the cable coupling firmly on the connector threads.
3. Connect the Ethernet cable to the DCM (2). Connect the other end of the Ethernet cable to e.g. the cobot controller.





2.3 INSTALLING KEMPPI COBOTICS APPLICATION

Kemppi Cobotics application is used for configuring DCM network settings and for viewing the communication between the cobot and the welding system. Welding settings are configured in the welding system's control panel.

For Kemppi Cobotics application, a DCM firmware version 1.00.92.0 or newer is required. (For welding equipment firmware versions, refer to "General" on page 3.)

1. Scan the QR code below or search for 'Kemppi Cobotics' in Google's Play Store.
2. Install the application.
3. Open the application.

2.4 CONNECTING FIELDBUS CONVERTER (OPTIONAL)

The fieldbus converter changes the Modbus TCP fieldbus connection into an Ethernet/IP connection.

Install the fieldbus converter by connecting it to the DCM and e.g. the cobot controller with two Ethernet cables. Then configure the cobot to communicate with the fieldbus converter (refer to the cobot controller's operating manual).

Installation

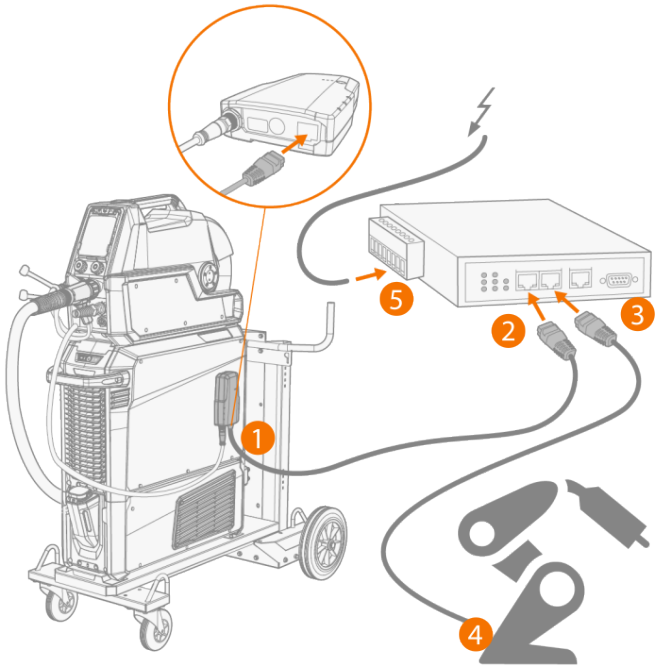
It is recommended to use a shielded Ethernet cable (minimum F/UTP – foil shielded / unshielded twisted pair).

The voltage supply to the fieldbus converter is typically provided via the cobot's IO outputs. If the voltage supply is not available from the cobot, an external voltage supply is required.

1. Connect an Ethernet cable to the DCM's Ethernet port (1).
2. Connect the other end of the cable to an Ethernet port in the fieldbus converter (2).
3. Connect another Ethernet cable to an Ethernet port in the fieldbus converter (3).
4. Connect the other end of the cable to e.g. a cobot controller (4).

You can connect the DCM and the cobot controller to either of the Ethernet ports (2 and 3) on the fieldbus converter.

5. Connect the voltage supply cable (5).



Configuration

The following lists the fieldbus converter's preconfigured configuration settings that are used for the communication between the cobot and the fieldbus converter.

Parameter	Value	Description
IP address	192.168.127.254	IP address of the fieldbus converter delivered by Kemppi.
Vendor ID	991	Vendor ID of the fieldbus converter.
Device type	12	Device type of the fieldbus converter.
Product code	1028	Product code of the fieldbus converter.
Major revision	0	Firmware version number of the fieldbus converter.
Minor revision	0	Firmware version number of the fieldbus converter.
Safe device	No	Indicates whether the fieldbus converter is an ODVA-certified safety device.
Output assembly	100	Output assembly object used for I/O messaging from the cobot to the fieldbus converter.
Output size (bytes)	30	Size of the output assembly object in bytes.
Input assembly	110	Input assembly object used for I/O messaging from the fieldbus converter to the cobot.
Input size (bytes)	30	Size of the input assembly object in bytes.
Configuration assembly	5	Configuration object used for I/O messaging from the cobot to the fieldbus converter.
Configuration size	0	Size of the configuration assembly object in bytes.
Input connection type	Point-to-point	A direct, one-to-one connection between the fieldbus converter and another device on the network, such as the cobot controller.
Output RPI	10 ms	Output RPI (Requested Packet Interval) determines the frequency at which the cobot sends output data to the fieldbus converter.
Input RPI	10 ms	Input RPI determines the frequency at which the fieldbus converter sends input data to the cobot.

For information on the DCM settings, refer to "DCM settings" on page 16.

For information on the fieldbus control tables, refer to "Fieldbus control table" on page 19. (The Modbus TCP fieldbus control tables also apply to the Ethernet/IP connection).

The fieldbus converter assumes that the DCM is located at IP address 192.168.127.250. If you change the DCM IP address, you need to update each Modbus command in the fieldbus converter's management console.

To change the fieldbus converter's Modbus Client configuration, refer the fieldbus converter's operating manual.

The credentials for the preconfigured fieldbus converter's management console are:

Username: admin

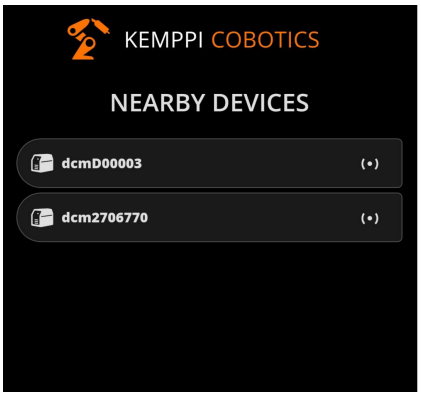
Password: Kempp1Cobotic5

3. OPERATION

3.1 PAIRING WITH MOBILE DEVICE

In order to activate the DCM, a mobile device running the Kemppi Cobotics application must be connected to the DCM via a wireless connection.

1. Ensure that the green LED (B) is lit and that the blue LED (C) blinks infrequently on the DCM device. For more information, refer to "Equipment description" on page 5.
2. Open the Kemppi Cobotics application on your mobile device. The application automatically starts searching available DCM devices.



3. On the list, select the DCM and welding equipment you wish to connect to.

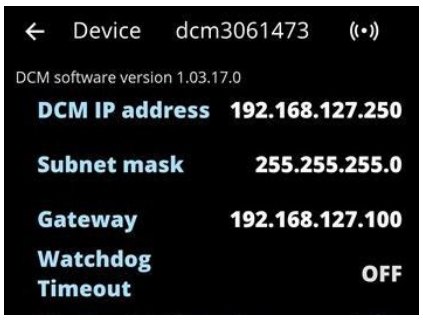
If there are several DCM devices available to choose from and you are uncertain which is which, you can press the function button on the DCM device briefly (1 sec.) to turn on its beacon. An orange indicator is shown next to the device in question.

Once the connection is made, the blue LED (C) on the DCM device is lit continuously. Notice that only one mobile device can be connected to the DCM at a time.

3.2 DCM SETTINGS

This section describes how to configure the DCM settings with the Kemppi Cobotics application.

1. Select the parameter for adjusting.
   >> Depending on the parameter to be adjusted, refer also to the Settings parameters table below for more details.



2. Enable the Modbus TCP interface by setting the 'Modbus TCP interface' to ON.

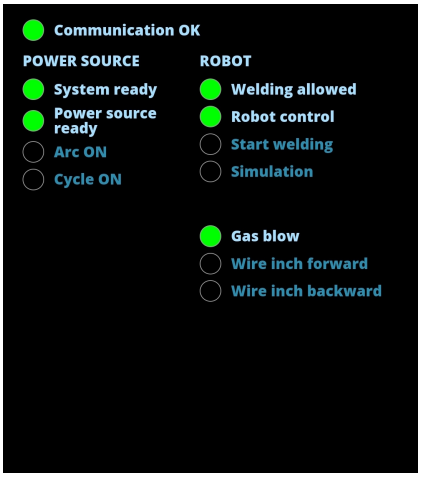
Tip: You can go back to the list of devices by clicking the device information bar at the top of the device view.

DCM settings

Parameter	Value	Description
Modbus TCP interface	ON/OFF	Enables or disables the Modbus TCP fieldbus interface used for the communication between the welding equipment and the robot.
DCM IP address	E.g. 192.168.127.250	IP address of the DCM. Note that the DCM IP address used by the fieldbus converter is 192.168.127.250 (refer to "Connecting fieldbus converter (optional)" on page 12).
Subnet mask	0.0.0.0 ... 255.255.255.255 Default = 255.255.255.0	DCM subnet mask.
Gateway	E.g. 192.168.127.1	IPv4 address of the gateway (if used).
Watchdog timeout	0 ... 65535 ms Default = 0 (OFF)	When the watchdog timeout is set, the robot must toggle the watchdog control bit between states 1 and 0 continuously when the robot control mode is enabled. If the robot stops toggling, a watchdog timeout occurs, and the welding system stops and gives a watchdog error.

3.3 STATUS INFORMATION

In the Kemppi Cobotics application you can view the communication between the welding system and the cobot.



Parameter	Description
General	
Communication OK	Green light: Communication between the welding system and the cobot has been established. No light: Communication between the welding system and the cobot has not been established.
Power source	
System ready	Green light: The welding system is ready for welding. All system devices are correct and working. No light: The welding system is not ready for welding.
Power source ready	Green light: The power source is ready to start a new weld. No light: The power source is not ready to start a new weld.
Arc ON	Green light: The welding arc is established. No light: The welding arc is not established.
Cycle ON	Green light: The welding cycle is in progress (the pre gas and post gas phases are included in the welding cycle). No light: The welding cycle is complete.
Robot	
Welding allowed	Safeguards the StartWelding bit so that welding cannot be started if the cobot is not ready. Green light: The cobot is ready to start a new weld. No light: The cobot is not ready to start a new weld.
Robot control	Green light: Certain functions, such as wire inch and gas test, switch to cobot mode in the welding equipment and the welding gun trigger is disabled. No light: No functions are in cobot mode and the welding gun trigger is enabled.
Start welding	Starts welding or simulation if the simulation mode is ON. Green light: The cobot has requested welding or simulation. No light: The cobot has not requested welding or simulation.

Simulation	Green light: The simulation mode is ON. During welding in the simulation mode the arc is not lit and wire is not fed. In this mode the operation of the Arc ON and Cycle ON bits is simulated without an ignited arc. The StartWelding bit controls simulation. No light: The simulation mode is OFF. The StartWelding bit controls welding.
Gas blow	Green light: The shielding gas valve is open for gas blow. No light: The shielding gas valve is closed.
Wire inch forward	Green light: The wire inch forward function is ON. No light: The wire inch forward function is OFF.
Wire inch backward	Green light: The wire inch backward function is ON. No light: The wire inch backward function is OFF.

For the Modbus TCP fieldbus control table and the control and status parameters, refer to "Fieldbus control table" on the next page.

3.4 FIELDBUS CONTROL TABLE

This section describes the fieldbus control table for Modbus TCP and EtherNet/IP connections.

EtherNet/IP connection is possible with the fieldbus converter (refer to "Connecting fieldbus converter (optional)" on page 12).

For information on setting the control bit states for starting welding, refer to "Setting control bit states to start welding" on page 25.

Control parameters (from cobot to welding system)

Register (word)	Coil	Data type	Bit	Control parameter
0	0	Bit	0	StartWelding
	1	Bit	1	RobotReadyToWeld
	2	Bit	2	OnlineControl
	3	Bit	3	GasBlow
	4	Bit	4	WireInchForward
	5	Bit	5	WireInchBackward
	6	Bit	6	SimulationOn
	7	Bit	7	RobotControlMode
	8	Bit	8	Watchdog
	9	Bit	9	HotStartOn
	10	Bit	10	CraterFillOn
	11	Bit	11	TouchSensorOn
	12	Bit	12	(Not in use)
	13	Bit	13	(Not in use)
	14	Bit	14	(Not in use)
	15	Bit	15	(Not in use)
1	UINT16			MemoryChannel
2	UINT16			WireFeedSpeed/Current/PlateThickness
3	UINT16			Voltage/FineTuning
4	UINT16			(Not in use)
5	UINT16			Dynamics
6	UINT16			PostCurrent
7	UINT16			(Not in use)
8	UINT16			(Not in use)
9	UINT16			(Not in use)
10	UINT16			(Not in use)
11	UINT16			(Not in use)

Status parameters (from welding system to cobot)

Register (word)	Discrete input	Data type	Bit	Status parameter

0	0	Bit	0	WeldingSystemReady
	1	Bit	1	PowerSourceReady
	2	Bit	2	ArcOn
	3	Bit	3	CycleOn
	4	Bit	4	WeldingVoltageAdjustOn
	5	Bit	5	Error
	6	Bit	6	WorkMemoryChannel
	7	Bit	7	WatchdogTriggered
	8	Bit	8	WeldingSystemAccess
	9	Bit	9	OnlineControlValuesValid
	10	Bit	10	TouchSensed
	11	Bit	11	(Not in use)
	12	Bit	12	(Not in use)
	13	Bit	13	(Not in use)
	14	Bit	14	(Not in use)
	15	Bit	15	(Not in use)
1	UINT16			TAST
2	UINT16			WeldingWireFeedSpeed
3	UINT16			WeldingVoltage
4	UINT16			WeldingCurrent
5	UINT16			ErrorNumber
6	UINT16			UserNumber
7	UINT16			ActiveMemoryChannel
8	UINT16			WeldingArcVoltage
9	UINT16			WatchdogTimeoutValue
10	UINT16			WeldingProcess
11	UINT16			TravelSpeed

Control information

Control information from the cobot to the welding system is transmitted as parameters and individual bits (signals) in the fieldbus control table.

Control parameters:

Parameter name	Parameter value	Raw (bus) value	Description
WireFeedSpeed	0.5 ... 25.0 m/min	5 ... 250	In online control mode: - WireFeedSpeed controls the wire feed speed in applicable processes. - Current controls the current in 1-MIG + WisePenetration, and Pulse + WisePenetration combinations. - PlateThickness controls the plate thickness in MAX Position process.
Current	0 ... 1024 A	0 ... 1024	
PlateThickness	0.0 ... 50.0 mm, step 0.1	0 ... 500	

Voltage/FineTuning	Voltage: 8.0 ... 46.0 V FineTuning: -10...+10	Voltage: 80 ... 460 FineTuning: 0...200	Controls the welding voltage for the MIG process in online control mode. For other welding processes FineTuning function is used instead.
MemoryChannel	0 ... 100	0 ... 100	Controls the active memory channel.
Dynamics	-10 ... +10	0 ... 20	Controls the dynamics for the synergic welding processes in online control mode. Dynamics controls the short circuit behavior of the arc. The lower the value the softer the arc, the higher the value the rougher the arc. (Not available with pulse, double pulse, WiseRoot+, MAX Cool or MAX Speed processes.)
PostCurrent	-30 ... + 30	0 ... 60	Controls the post current in online control mode. Post current setting affects the wire length at the weld end, for example to prevent the wire from stopping too close to the weld pool. This also enables the optimum wire length for the start of the next weld.

Control bits:

Control bit name	Bit state 0	Bit state 1	Requirements	Description
StartWelding	Welding / simulation OFF	Welding / simulation ON	RobotControlMode = 1 and WeldingAllowed = 1	Starts the welding sequence. If the simulation mode is ON (SimulationOn = 1), this controls the simulation sequence instead.
RobotReadyToWeld	Cobot is not ready to weld (StartWelding disabled)	Cobot is ready to weld (StartWelding enabled)	RobotControlMode = 1	Safeguards the StartWelding bit so that welding cannot be started if the cobot is not ready.
OnlineControl	Channel control (values from memory channel are used)	Online control (cobot controls certain welding parameters)	RobotControlMode = 1	Enables cobot-controlled values for certain parameters. In online control mode, the parameter values in the active memory channel are overridden. In channel control mode, the values from the active memory channel are used. For more information, refer to "Online control" on page 30.
GasBlow	Gas blow OFF	Gas blow ON	RobotControlMode = 1	Opens the shielding gas valve for testing / purging purposes. During welding the gas valve is controlled automatically, so during welding this bit has no effect.
WireInchForward	Wire inch forward OFF	Wire inch forward ON	RobotControlMode = 1	Feeds the welding wire forward. The wire is fed at the speed of 1.0 m/min for 3 seconds and then 5.0 m/min.

WireInchBackward	Wire inch backward OFF	Wire inch backward ON	RobotControlMode = 1	Feeds the welding wire backwards. The wire is fed at the speed of 1.0 m/min for 3 seconds and then stepped to 5.0 m/min.
SimulationOn	No simulation mode: Normal welding sequence	Simulation mode: Simulated welding sequence (arc is not lit)	RobotControlMode = 1	Turns the welding simulation mode ON and OFF. During simulated welding the arc is not established.
RobotControlMode	Cobot control mode disabled. Cobot cannot control the welding equipment, welding gun trigger is enabled.	Cobot control mode enabled. Cobot can control the welding equipment, the welding gun trigger is disabled.		Defines whether the cobot has control of the welding equipment. When the cobot controls the welding equipment, the welding gun trigger is disabled.
Watchdog	-	-	RobotControlMode = 1	If you set a value for the watchdog timeout parameter (in the Kemppi Cobotics application), the cobot must toggle the watchdog control bit between states 1 and 0 continuously when the cobot control mode is enabled. If the cobot stops toggling, a watchdog timeout occurs (WatchdogTriggered bit state = 1), and the welding system stops and gives a watchdog error.
HotStartOn	Hot start OFF	Hot start ON		Sets the hot start function ON or OFF in online control mode. Hot start is a welding function that uses higher or lower wire feed speed and welding current at the start of the weld. After the hot start period the current changes to normal welding current level. This facilitates the start of the weld especially with aluminum materials.

CraterFillOn	Crater fill OFF	Crater fill ON		Sets the crater fill function ON or OFF in online control mode. When welding with high power, a crater is usually formed at the end of the weld. The Crater fill function decreases the welding power / wire feed speed at the end of the welding job so that the crater can be filled using a lower power level.
TouchSensorOn	Touch sensor OFF	Touch sensor ON	RobotControlMode = 1	Sets the touch sensor ON/OFF.

Status information

Status information from the welding system to the robot is transmitted as parameters and individual bits (signals) in the fieldbus control table.

Status parameters:

Parameter name	Parameter value	Raw (bus) value	Description
WeldingWireFeedSpeed	0 ... 25.5 m/min	0 ... 255	Measured welding wire feed speed.
WeldingVoltage	0 ... 6553.5 V	0 ... 65535	Measured welding (terminal) voltage.
WeldingCurrent	0 ... 65535 A	0 ... 65535	Measured welding current.
TAST	0 ... 8191	0 ... 8191	TAST (Through Arc Seam Tracking) value. TAST is used for providing precise welds depending on specific weld characteristics or in setups where the position of the work piece varies during repetitive tasks.
ErrorNumber	0 ... 65535	-	System error / warning number.
UserNumber	0 ... 10	0 ... 10	Current user number.
ActiveMemoryChannel	0 ... 99	0 ... 99	Current memory channel number.
WeldingArcVoltage	0 ...6553.5 V	0 ... 65535	Measured welding arc voltage.
WatchdogTimeoutValue	0 ... 65535	0 ... 65535	Watchdog timeout defined by the user.

WeldingProcess	0 ... 18 0 = Unknown 1 = MIG 2 = 1-MIG 3 = Pulse MIG 4 = DPulse MIG 9 = WiseRoot 10 = WiseThin 11 = WiseRoot+ 14 = WiseTh-in+ 16 = MAX Speed 17 = MAX Cool 18 = MAX Position	0 ... 18	Current welding process.
TravelSpeed	0 ... 65535 mm/min	0 ... 65535	The travel speed recommended by Weld Assist (the value is 0 when not applicable).

Status bits:

Status bit name	Bit state 0	Bit state 1	Description
WeldingSystem Ready	Welding system is not ready	Welding system is ready	Indicates whether the welding system is ready to be used for welding. The system is ready when all necessary devices are present and no error is active.
PowerSourceReady	Power source is busy	Power source is ready for a new weld	Indicates whether the power source is ready to start a new weld. The power source is ready when the robot has not requested welding and crater fill is not ongoing.
ArcOn	No welding arc	Welding arc established	Indicates whether welding arc is established.
CycleOn	Welding cycle not active	Welding cycle active	Indicates whether welding cycle is ongoing. The welding cycle includes also pre gas, creep start, crater fill and post gas phases.
WeldingVoltageAdjustOn	Voltage/FineTuning parameter controls the fine tuning value	Voltage/FineTuning parameter controls the welding voltage value	Describes whether the Voltage/FineTuning parameter controls the welding voltage or the fine tuning value.
Error	No error or only a warning	Error in welding system	Indicates whether there is an error in the system that prevents welding.
WorkMemoryChannel	Normal memory channel	Working memory channel	Indicates whether the current channel is a working channel.

WatchdogTriggered	OK	Watchdog timeout has occurred	Bit state 1 indicates that the watchdog timeout has been exceeded and the welding system has stopped.
WeldingSystemAccess	No access (the welding parameters are read-only)	Full access to welding system parameters	Indicates whether the Modbus TCP server has access to control the welding system's parameters.
OnlineControlValuesValid	-	-	Indicates when online control values are valid.
TouchSensed	Touch is not detected	Touch is detected	Indicates if a touch is detected between the wire and the work piece. The touch sensor must be set active with the TouchSensorOn control bit.

3.4.1 SETTING CONTROL BIT STATES TO START WELDING

This section describes the control bits and their states required to start welding with the cobot.

1. Set the control bit RobotControlMode to state 1.
   >> Sets the welding machine to the cobot control mode.
2. Set the control bit RobotReadyToWeld to state 1.
   >> The cobot allows welding and gives the welding machine permission to ignite the arc.
3. To ignite the arc, set the control bit StartWelding to state 1. If you want to simulate the welding sequence without igniting the arc, set the control bit SimulationOn to state 1.

3.5 TIMING DIAGRAMS

"Welding start and stop timing" below

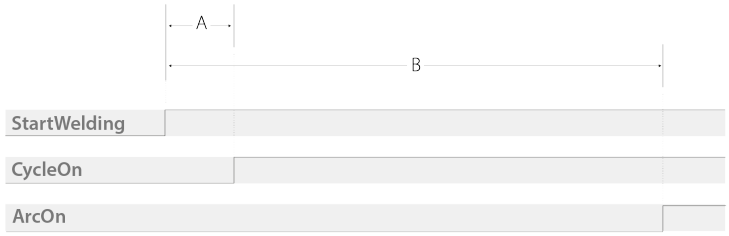
"Memory channel change timing" on the next page

"Wire inch timing" on the next page

"Online control timing" on the next page

3.5.1 WELDING START AND STOP TIMING

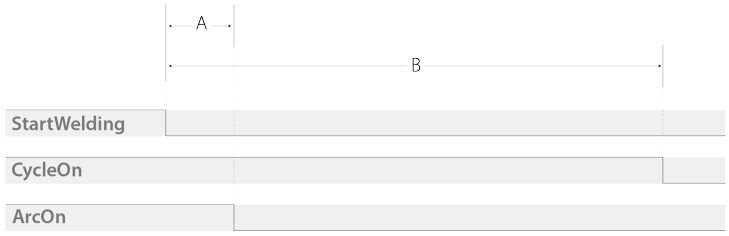
Welding start timing



Item	Description	Min	Typical	Max	Units
A	Cycle on	5	30	50	ms
B	Arc estab-lishment	100	Pre gas time + distance of the wire from the work piece + 150	*	ms

*The maximum time is limited by the wire feeding timeout.

Welding stop timing



Symbol	Description	Min	Typical	Max	Units
A	Arc OFF time	60	70	-	ms
B	Cycle OFF time	100*	Post gas time + 20	-	ms

* If the post gas time is less than 100 ms, the minimum cycle OFF time is determined by the power source shutdown time.

3.5.2 MEMORY CHANNEL CHANGE TIMING

Description	Min	Typical	Max	Units
Total time	0.5	1	2.5	s

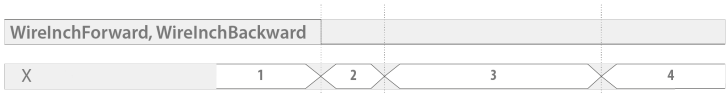
3.5.3 WIRE INCH TIMING

This section describes the timing for the wire inch forward and wire inch backward functions when controlled by the robot.

Wire inch startup timing

Item	Description	Min	Typical	Max	Units
1	Wire feeding OFF	-	-	-	-
2	Startup	20	40	100	ms
3	Wire feeding, slow phase	3	3	3	s
4	Wire feeding, fast phase	-	-	-	-
X	Welding equipment	-	-	-	-

Wire inch stop timing



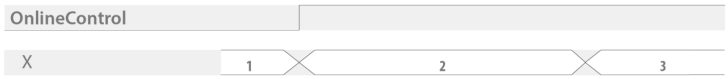
Item	Description	Min	Typical	Max	Units
1	Wire feeding ON	-	-	-	-
2	Stop	-	40	-	ms
3	Wire feeding deceleration	-	30	-	ms
4	Wire feeding OFF	-	-	-	-
X	Welding equipment	-	-	-	-

3.5.4 ONLINE CONTROL TIMING

In online control mode, the cobot controls the values of certain parameters directly.

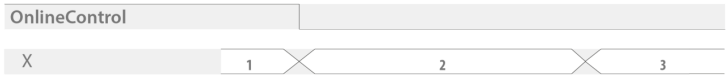
In channel control mode the values of the parameters come from the memory channel.

Switching to online control mode



Item	Description	Min	Typical	Max	Units
1	Channel control mode	-	-	-	-
2	Data setup time	-	4	-	s
3	Online control mode	-	-	-	-
X	Welding equipment	-	-	-	-

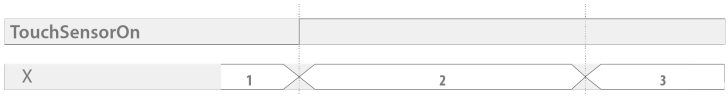
Switching to channel control mode



Item	Description	Min	Typical	Max	Units
1	Online control mode	-	-	-	-
2	Data setup time	-	4	-	s
3	Channel control mode	-	-	-	-
X	Welding equipment	-	-	-	-

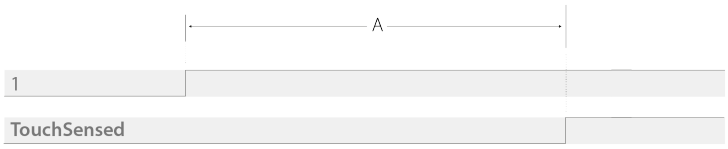
3.5.5 TOUCH SENSOR TIMING

Touch sensor start timing



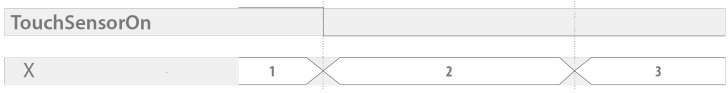
Item	Description	Min	Typical	Max	Units
1	Touch sensor OFF	-	-	-	-
2	Start response time	35	40	80	ms
3	Touch sensor ON	-	-	-	-
X	Welding equipment	-	-	-	-

Touch response timing



Item	Description	Min	Typical	Max	Units
A	Touch signal function reaction time	10	15	20	ms
1	Short circuit (touch)	-	-	-	-

Touch sensor off timing



Item	Description	Min	Typical	Max	Units
1	Touch sensor ON	-	-	-	-
2	Control response time	20	35	60	ms
3	Touch sensor OFF	-	-	-	-
X	Welding equipment	-	-	-	-

3.6 ONLINE CONTROL

The online control function is supported by the X5 FastMig AP/APC equipment with firmware version 1.50 SP2 or later, and Master M 358 with firmware version 1.20 or later.

The online control function allows the cobot to adjust certain welding parameters directly. This allows the cobot to change welding parameters during welding, for example when changing the welding position or welding around a corner.

The cobot can adjust the following parameters in online control mode:

Parameter	Default value
WireFeedSpeed	0.5 m/min
Current	0 A
PlateThickness	0.0 mm
Voltage	8.0 V
FineTuning	0
Dynamics	0
PostCurrent	0
HotStartOn	OFF (0)
CraterFillOn	OFF (0)

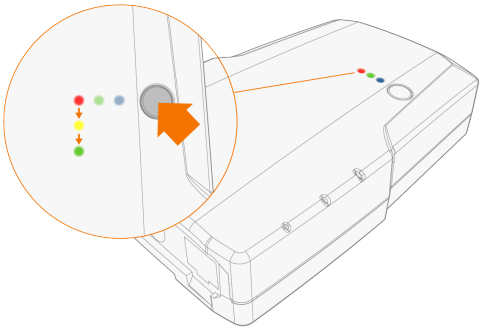
The online control function is used in the following way:

1. Before welding starts, the cobot sets the 'OnlineControl' control bit to state 1.
2. The cobot selects the correct memory channel for welding.
3. The cobot adjusts the values of all online control parameters available in the fieldbus control table.
4. The cobot starts welding in online control mode by setting the 'StartWelding' control bit to state 1.
5. The cobot adjusts online control parameters during welding if necessary.
6. The cobot stops welding by setting the 'StartWelding' control bit to state 0.

3.7 RESETTING

The DCM can be reset to factory settings with a long-press of the button on the module.

1. Ensure that the DCM is ready and available: Blue LED (C) blinks infrequently.
2. Press the button on the DCM device for 30 seconds:
   >> After the first 10 seconds, the leftmost LED turns red.
   >> After 20 seconds, the leftmost LED turns yellow.
   >> After 30 seconds, the leftmost LED turns green.



3. When the leftmost LED is lit in green, release the button.

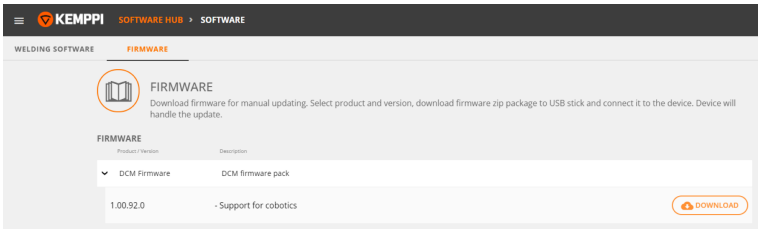
Now the factory settings have been restored and the welding data erased from the memory.

3.8 UPDATING DCM

To update the DCM firmware, follow these instructions.

Download update

1. Sign in to Kemppi software hub on your computer.
2. Connect a USB memory stick to the computer.
3. Download the firmware package from the Kemppi software hub's **Software**> **Firmware** > **DCM** > page.



4. Save the firmware package file to the root folder of the USB memory stick.
5. Remove the USB memory stick from the computer.

Install update

1. Start the welding machine attached to the DCM and wait approx. 10 seconds until the DCM is on standby.
2. Insert the USB memory stick to the DCM's USB connector.

   >> A green light starts to blink slowly.
3. Wait until the leftmost light starts to blink rapidly.
4. Remove the USB memory stick from the DCM's USB connector.

   >> DCM will automatically reboot.
5. Keep the DCM turned on for at least 1 minute. This allows the DCM to set the installed firmware as default.

   >> The update is now complete.

4. TECHNICAL DATA

Feature	Value
Operating voltage	12...48 V
Operating temperature range	-20...40 °C
Degree of protection	IP24
External dimensions *L x W x H*	30 x 104 x 171
Weight without accessories	0.235 kg
Wireless communication type	2.4 GHz, dual mode
Wired communication type	CAN, USB, Ethernet
Standards	IEC 60974-1:2012 IEC 60974-10:2014 + A1

5. ORDERING CODES

Product	Ordering code
Digital Connectivity Module (DCM)	6265051