

1 Installer manual

1.1 General instructions

This manual aims at providing information to install the CRS receiving unit of Autec Dynamic series radio remote controls.

Instructions regarding the use of the radio remote control are contained in the "user manual" (provided together with the radio remote control). This manual and the "user manual" must be read and understood in all their parts by those who decide and/or carry out the radio remote control installation.

Always remember that:

- photos and drawings contained in this manual are useful examples that help understand its instructions and warnings
- if necessary, contact Autec if any of the instructions and/or warnings given in this manual are not clear.

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If this manual is lost or damaged, ask Autec for a copy. Please specify the serial number of the related radio remote control.






All installation operations can only be carried out by qualified technicians who are suitably trained with respect to the relevant norms and laws.

This manual integrates instructions provided by the manufacturer of the machine where the radio remote control is to be installed.

As for instructions and warnings regarding the machine where the radio remote control is to be installed, follow the instructions given in the machine's manual.

1.2 Symbol conventions

Three symbols are employed in this manual, which are used to highlight specific safety-related issues. They are classified according to the hazardous situation that may arise and on the possible consequences:

Symbol	If the highlighted instructions are not respected ...		
	... a dangerous situation will occur consequences for people may be consequences for property may be ...
 DANGER	... very likely.	... critical (death or physical damage).	... critical.
 WARNING	... probably.	... critical (death or physical damage).	... critical.
 CAUTION	... probably.	... moderate (non-severe physical damage).	... moderate.



This symbol is also used, and it identifies texts to be read carefully.

Index

Back

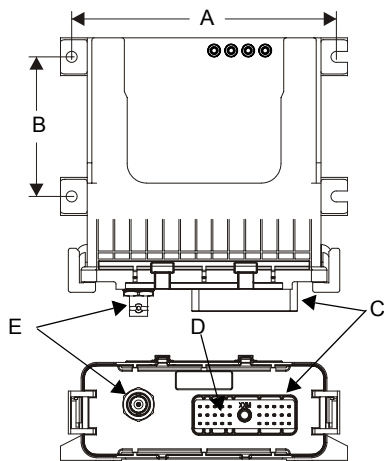
2 CRS receiving unit

2.1 Description

The receiving unit uses the CANopen® communication protocol to communicate in a CAN bus network. The receiving unit acts as a slave node within this network.
STOP and SAFETY commands are sent via CAN network and also activate their corresponding outputs.



It is not possible to only rely on the CAN communication status to maintain or bring the remote controlled machine to a safe condition. Messages sent by the radio remote control via CAN network do not in fact ensure the same safety features as the corresponding commands that are directly carried out by the receiving unit's safety outputs. Please refer to chapters 7 and 6 for instructions to correctly wire such outputs.



A	141 mm (5.55 In)
B	74 mm (2.91 In)
C	plug
D	pins on the plug
E	BNC connector for antenna



Receiving unit's pins are identified through their corresponding cavities on the connector (see paragraph 4.2.1).

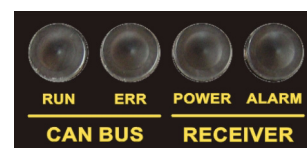
2.2 Technical data

Power supply	8-30 V $\overline{\text{=}}$
Absorbed power	3 W
Antenna	dedicated
Outputs' maximum switching voltage	30 V $\overline{\text{=}}$
Rated current of outputs STP_1 and STP_2 with electronic protection (restorable)	8 A
Protection of STP_1 and STP_2 (fail safe)	15 A
Rated current of SAF_1 with electronic protection (restorable)	8 A
Protection of SAF_1 (fail safe)	15 A
Rated current of SAF_2	2 A
Protection of SAF_2 (restorable)	4 A (25°C)
Housing material	PBT (30% fg) and PA6 (30% fg)
Protection degree	IP65
Dimensions	153 x 148 x 55 mm (6.1 x 5.9 x 2.2 In)
Weight	0.5 kg (1.1 Lb)

3 Light signals

The CRS receiving unit has four LEDs:

- POWER is green
- ALARM is red
- RUN is green
- ERR is red



3.1 POWER LED (green)

The POWER LED indicates the status of the receiving unit and of the radio link.

The POWER LED ...	Meaning
... is off	The receiving unit is switched off.
	Radio link has been built.
... is on	No radio link.

3.2 ALARM LED (red)

The ALARM LED warns about anomalies in the receiving unit.

The ALARM LED ...	Meaning
... is off	The receiving unit works correctly.
	Error on the STOP outputs.
	Error on the SAFETY outputs.
... is on	The receiving unit does not work correctly.

3.3 RUN LED (green)


RUN LED signals reflect the guidelines of the CANopen® standard, CiA recommendation 303-3. Terms used in the following table are therefore consistent with such recommendation.

The RUN LED indicates the status of the application layer (CANopen node).

The RUN LED ...	Meaning
... is off	The CAN node is off: the receiving unit is switched off or is performing a reset
	The CAN node does not send commands on the network: configuration through the LSS services is in progress
	The CAN node does not send commands on the network: the receiving unit is in state PREOPERATIONAL

[Index](#)





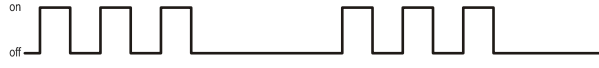
[Back](#)

The RUN LED ...	Meaning
... repeats the sequence: a slow blink and a pause 	The CAN node does not send commands on the network: the receiving unit is in state STOPPED
... is on	The CAN node is working correctly: the receiving unit is in state OPERATIONAL

3.4 ERR LED (red)

ERR LED signals reflect the guidelines of the CANopen® standard, CiA recommendation 303-3. Terms used in the following table are therefore consistent with such recommendation.

The ERR LED indicates the status of the (CAN bus) physical layer and errors due to wrong configurations.

The ERR LED ...	Meaning
... is off	No operating problems.
... blinks fast 	CAN communication is not available: configuration through the LSS services is in progress
... blinks slowly 	CAN communication does not work correctly: configuration errors on the receiving unit.
... repeats the sequence: a slow blink and a pause 	CAN communication does not work correctly: at least one of the frame error counters has reached the warning level.
... repeats the sequence: two slow blinks and a pause 	CAN communication does not work correctly: a "heartbeat event" or a "guard event" has occurred.
... repeats the sequence: three slow blinks and a pause 	CAN communication does not work: the SYNC message has not been received within the configured communication cycle period time out.
... is on	CAN communication does not work: the CAN controller is bus off.

4 Electrical connection

Connector indicated in paragraph 4.2.1 and the related terminals are used for the connection with the machine:

1. crimp wires (see paragraph 4.1)
2. insert terminated wires in the connectors (see paragraph 4.2)
3. insert the connector in the receiving unit's plug and screw it in with the screw (1/4 IN).


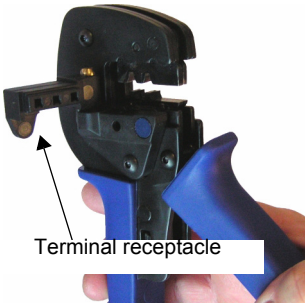




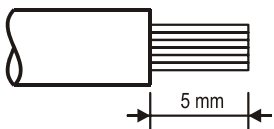

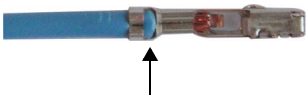
The connector has 30 cavities; each of them can only admit a single terminal, and a single wire can be crimped to each terminal.

4.1 Crimp

Use terminals CINCH 425-00-00-873 and the hand crimp tool CINCH 599-11-11-616 to crimp the wires. Do not use wires with sections smaller than what provided in the following indications.

	Power supply	SAFETY	STOP	Cable control	CAN BUS
Minimum section [sq. mm]	0.5	1	1	0.5	0.5

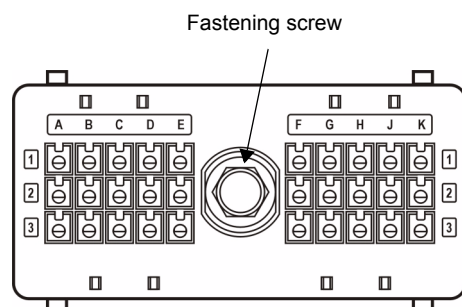
Instructions to crimp the wires	
<div>1</div> 	Grip the hand crimp tool securely and squeeze, ratcheting the mechanism until it bottoms out. Then allow it to open completely.
<div>2</div>  <div>Terminal receptacle</div>	With hand tool in ready position, (open handle) open the terminal receptacle.
<div>3</div> 	Insert a single terminal in the middle hole of the terminal receptacle.

Instructions to crimp the wires	
<p>4</p> 	<p>Close the terminal receptacle with the terminal in it.</p>
<p>5</p> 	<p>Pre-strip wire as shown in the drawing.</p>
<p>6</p> 	<p>Insert the pre-stripped wire into the terminal located in the hand crimp tool. With the terminal and wire set in the proper position, hold the wire stationary and squeeze the tool together. Complete the crimp by squeezing the tool until the ratchet releases. Remove the terminated wire from the tool.</p>
<p>7</p> 	<p>A properly terminated wire would look similar to the drawing. The arrow shows the approximate point where the end of the insulation should be placed.</p>

4.2 Connection

4.2.1 Connector

Use connector CINCH 581-01-30-029 to connect the terminated wires to the plugs on the receiving unit.

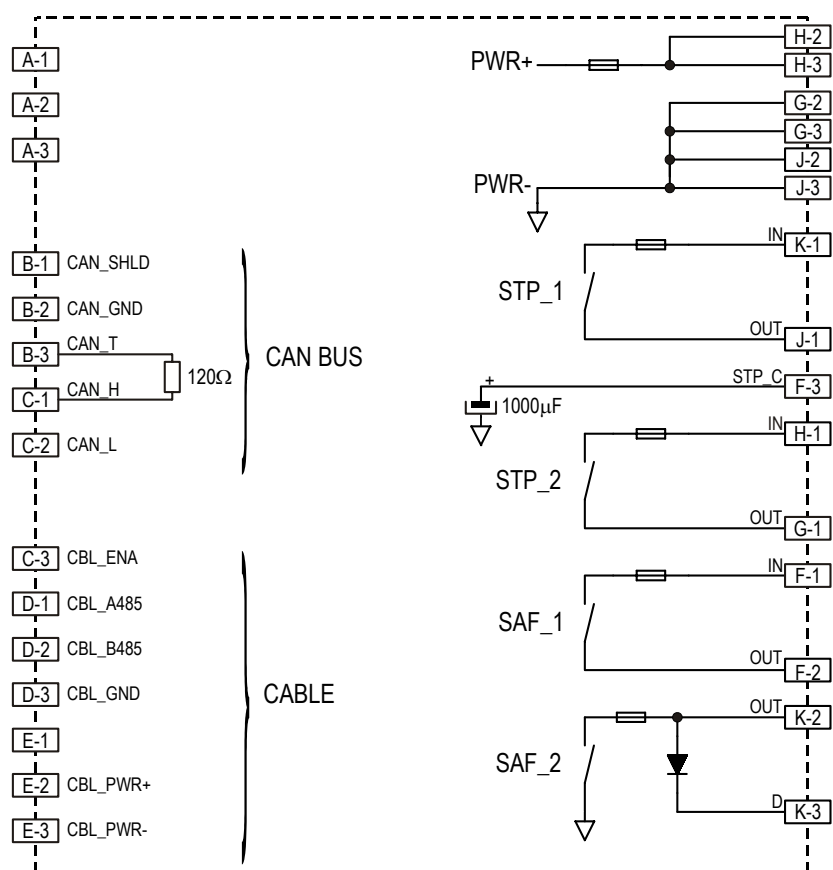


	A	B	C	D	E
1	/	CAN_SHLD	CAN_H	A485_CBL	/
2	/	CAN_GND	CAN_L	B485_CBL	PWR+_CBL
3	/	CAN_T	ENA_CBL	GND_CBL	PWR-_CBL

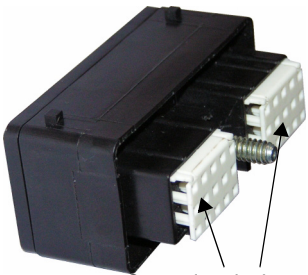
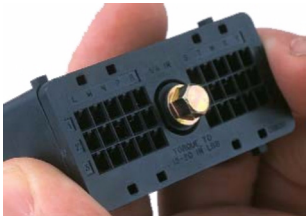
F	G	H	J	K	
SAF_1_IN	STP_2_OUT	STP_2_IN	STP_1_OUT	STP_1_IN	1
SAF_1_OUT	PWR-	PWR+	PWR-	SAF_2_OUT	2
STP_C	PWR-	PWR+	PWR-	SAF_2_D	3

Name	Cavity/pin	Description	Function
/	A-1	reserved	/
/	A-2	reserved	
/	A-3	reserved	
CAN_SHLD	B-1	shield	CAN BUS (see paragraph 9)
CAN_GND	B-2	GND	
CAN_T	B-3	line termination (120 Ω)	
CAN_H	C-1	H	
CAN_L	C-2	L	
ENA_CBL	C-3	presence of cable control	Cable control (see paragraph 10)
A485_CBL	D-1	A	
B485_CBL	D-2	B	
GND_CBL	D-3	GND	
/	E-1	not connected	
PWR+_CBL	E-2	transmitting unit's power supply positive terminal	Power supply (see paragraph 8)
PWR-_CBL	E-3	transmitting unit's power supply negative terminal	
PWR-	G-2, G-3, J-2, J-3	negative	
PWR+	H-2, H-3	positive	SAFETY (see paragraph 7)
SAF_1_IN	F-1	power supply positive terminal of SAF_1	
SAF_1_OUT	F-2	output of SAF_1	
SAF_2_OUT	K-2	output of SAF_2	
SAF_2_D	K-3	reverse recovery diode	STOP (see paragraph 6)
STP_1_IN	K-1	power supply positive terminal of STP_1	
STP_1_OUT	J-1	output of STP_1	
STP_2_IN	H-1	power supply positive terminal of STP_2	
STP_2_OUT	G-1	output of STP_2	
STP_C	F-3	smoothing capacitor	

[Index](#)
[Back](#)

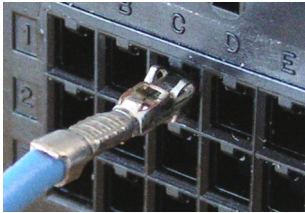




4.2.2 Inserting terminals in the connector

Instructions to wire the connector	
<p>1</p>  <p>Secondary lock</p>	<p>Before wiring, make sure that the secondary locks are in the pre-stage/open position, as shown in the picture.4.2.3</p>
<p>2</p> 	<p>Grasp connector with cavity letter and number identification in the upright position.</p>

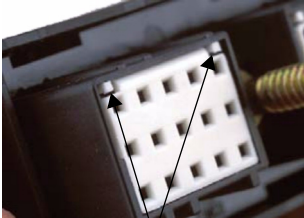
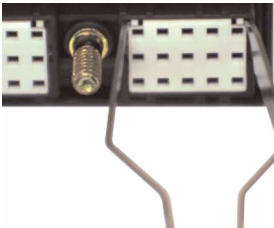
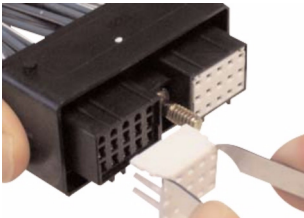
[Index](#)

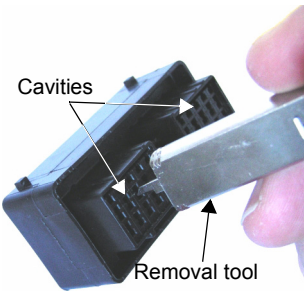
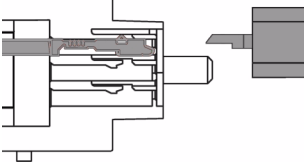
[Back](#)

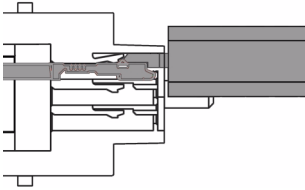
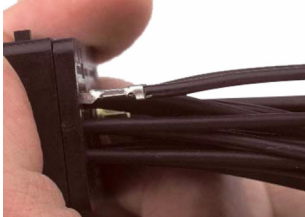
Instructions to wire the connector	
<div>3</div> 	<p>Insert the terminated wire in the corresponding cavity.</p>
<div>4</div> 	<p>Complete terminal insertion by pushing the terminated wire through the cavity until you hear a "click". Verify proper terminal seating with a light tug on the wire. Repeat step 3 until all wires are inserted. Use seal plugs in unused cavities.</p>
<div>5</div> 	<p>Completely insert the secondary locks. If a resistance is felt while closing the secondary lock, do not force to close.</p>

4.2.3 Removing terminals from the connector

- To remove the terminals from the connector, do the following:
- use the tweezers tool CINCH 599-11-11-628 to remove the secondary lock
 - use the terminal removal tool CINCH 581-01-18-920 to remove the terminals.

Removing the secondary lock	
<div>1</div> 	Position the connector so that secondary lock locking tabs are in an upright position.
<div>2</div> 	Insert the tweezers tool besides the secondary lock locking tabs.
<div>3</div> 	Push tweezers in and squeeze to remove the secondary lock out of the connector.

Terminal removal	
<div>1</div> 	Grasp connector with cavity letter and number identification in the upright position. Terminal removal tool is to be inserted in the front of the cavity, opposite to the wires.
<div>2</div> 	Locate wire to be extracted and its cavity in the front of the connector.

Terminal removal	
<div>3</div> 	<p>Insert the removal tool straight in, as show in the picture.</p>
<div>4</div> 	<p>Push the removal tool straight in so it bottoms against the connector. Make sure that the wire is inserted safely by pulling it for approx. 2mm without forcing. Remove the tool from the cavity. Pull the wire out.</p>

5 Warnings for installation



The radio remote control can only be installed and tested by competent staff that masters the technical knowledge required to carry out such procedure and is qualified according to the regulation of the country where the radio remote control is mounted.

Only if the radio remote control is installed correctly can it be used safely.

Besides instructions established by the machine's manufacturers, installers must always observe the following warnings.



Never connect power supply positive pole to the outputs' pins. Such connection would exclude the UMFS and STOP safety functions. In this case the machine may be in a dangerous condition, out of the user's control.

The installer or the machine's manufacturer must avoid that a power supply positive pole is connected to outputs' pins.



5.1 General

Respect and enforce the provisions of all reference standards relevant in the concerned application field (i.e. IEC 60204-32 for hoisting machines.)

Always follow the instructions provided in the "technical data sheet" and respect values given in the technical data to carry out correct installation.

Due to the characteristics of radio propagation (i.e.: EM interference, near out-of-range condition), a delay up to the "Passive stop time" may occasionally occur from the moment a command in the transmitting unit is released to the moment its corresponding output in the receiving unit is deactivated.

With regards to the SAFETY outputs only (SAF_1 and SAF_2), a regular deactivation delay (approx. 1 second) applied to such outputs may add to this time.

Those who decide upon the installation of the radio remote control must make sure that these delays never lead to a dangerous situation in the specific uses.



5.2 Mounting and fastening the receiving unit in the best position

Place the receiving unit so that it can be easily reached in case of need.

Place the receiving unit so that it can be easily reached, and far from heat sources (i.e. exhaust pipes, heat exchangers, radiators).

Place the receiving unit vertically, with the plug facing down.

The receiving unit's back should be placed against a metal surface, to improve heat sink effect.

Fix the receiving unit in four points, using the specific holes in the housing.

Do not perforate the receiving unit in any case.

If the unit is installed on machines that produce heavy vibrations, it is recommended to mount it on a metal plate and to fasten the metal plate to the machine with vibration dampers.



5.3 Mounting and fastening the antenna in the best position

Install the antenna so that shields, structures or materials do not obstruct the radio link; in particular:

- the antenna shall not be placed inside closed metal containers
 - the antenna must be installed in a vertical position, and possibly in sight of the work area
 - the antenna must be placed at least 50 cm far from metal objects in its surroundings.
- If these warnings are disregarded, the typical working range of the radio remote control may be reduced.**

Place the antenna as far as possible from the receiving unit and from other electrical and electronic devices.



WARNING

5.4 Wiring

Respect instructions provided in chapter 4 to connect the receiving unit with the machine.

Make sure that the receiving unit's power supply is protected against short circuits and is supplied either by a battery or by a power supply unit with safety isolating transformer.

The power supply of the receiving unit must have a switch that allows power supply disconnection during installation, wiring and/or maintenance operations. Connect the receiving unit immediately downstream of the machine main switch or of the electrical panel main switch (see chapter 8).

Pay special attention to the currents flowing in outputs SAF_1, SAF_2, STP_1 and STP_2: they shall not exceed the maximum permitted values (see paragraph 2.2).

The current of STOP outputs is interrupted at regular intervals for approx. 1 ms every 100 ms. If STOP outputs are used to power electronic devices, check that they are compatible with this recurring interruption (use suitable filters if necessary).

Fasten the wiring cables of the CRS receiving unit so as not to apply burdens on the wiring connectors.



WARNING

5.5 At end of installation

Make sure that during installation the safety mechanisms on the radio remote control and/or in the machine have not been made ineffective by possible procedures carried out.



WARNING

5.6 Testing

After installation and wiring, test the system "machine+radio remote control", and check that the operations carried out correspond exactly to the commands sent (in particular check the STOP command).

The installer must check and complete the "Technical Data Sheet" in all its parts, adding the date the system has been put into service, his stamp and signature.

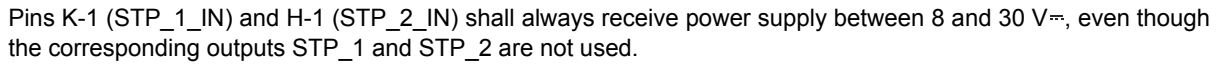
Make sure that outputs SAF_1 and SAF_2 only activate after the radio remote control start up.

In case of malfunction, disable the system "machine+radio remote control" until the problem has been completely solved.

[Index](#)[Back](#)

6 STOP outputs

Outputs STP_1 and STP_2 are enabled by the STOP command.

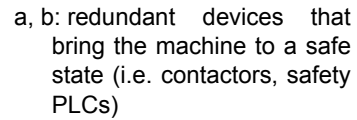


The current of STOP outputs is interrupted at regular intervals for approx. 1 ms every 100 ms. Risk analysis must consider this interruption.

Wiring of outputs STP_1 and STP_2 is the factor that defines the safety level for the UMFS protection function.

6.1 Stop function complying with cat. 4 PL=e and SIL 3

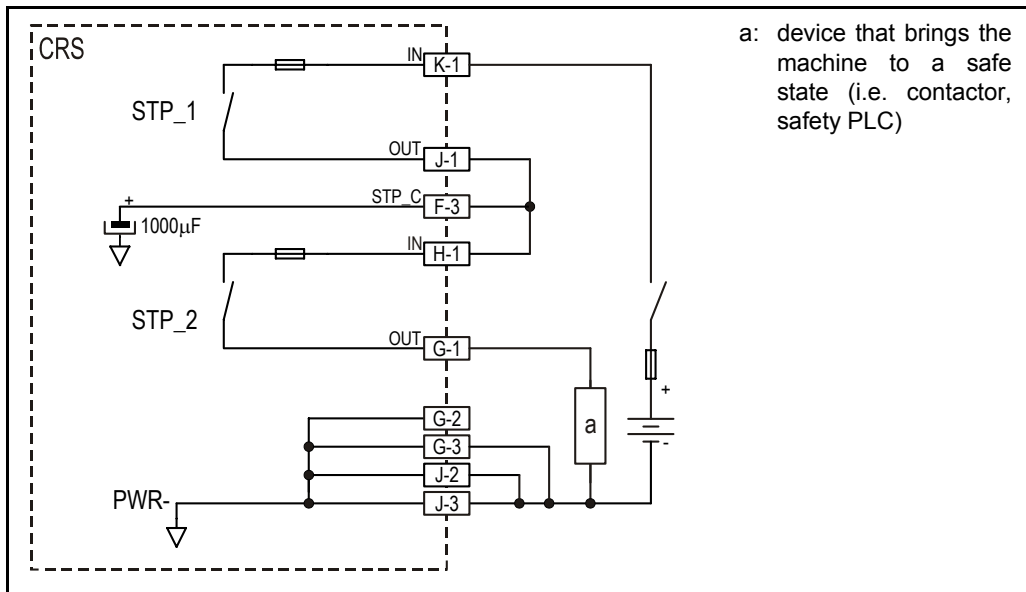
The stop function complies with cat. 4 and PL=e according to the EN ISO 13849-1 and with SIL 3 according to the EN IEC 62061 if outputs STP_1 and STP_2 in the receiving unit have been wired as follows:



The installer or the machine manufacturer is in any case responsible for carrying out wiring in such a way as to ensure the safety level required by risk analysis; in particular, short circuit among the wires of the STOP circuit outside the receiving unit must be avoided.

6.2 Stop function complying with cat. 3 PL=d and SIL 2

If outputs STP_1 and STP_2 require a 2-wire wiring, the stop function complies with cat. 3 and PL=d according to the EN ISO 13849-1 and SIL 2 according to the EN IEC 62061 if wiring is carried out as follows:



When outputs STP_1 and STP_2 are connected in series, wire cavity STP_C as shown in the figure, so that the filter capacitor is connected.



If failure not related to the CRS receiving unit occurs (i.e. short circuit between STP_2_IN and STP_2_OUT), the filter capacitor (1000 µF) may cause a further delay in de-energising the STOP circuit, thus extending the declared stop time. This delay depends on device “a” (i.e. new delay is shorter than 500 ms if impedance of device “a” is lower than 500 Ω or if such device absorbs constant current higher than 50 mA). Take into account this aspect when doing the risk analysis, as well as the fact that such failure is not detected by the radio remote control.



The installer or the machine manufacturer is in any case responsible for carrying out wiring in such a way as to ensure the safety level required by risk analysis; in particular, short circuit among the wires of the STOP circuit outside the receiving unit must be avoided.

7 SAFETY outputs

Outputs SAF_1 and SAF_2 are enabled by the SAFETY command.



Outputs SAF_1 and SAF_2 are designed to drive power loads and are protected through overvoltage suppressors and reverse recovery diodes, to ensure longest lifetime in most applications. If these outputs drive inductive loads (i.e. solenoid valves, relays), it is recommended to use a reverse recovery diode with the load, to further reduce the effects of demagnetisation currents.



Pin F-1 (SAF_1_IN) shall always receive power supply between 8 and 30 V_{DC}, even though output SAF_1 is not used.



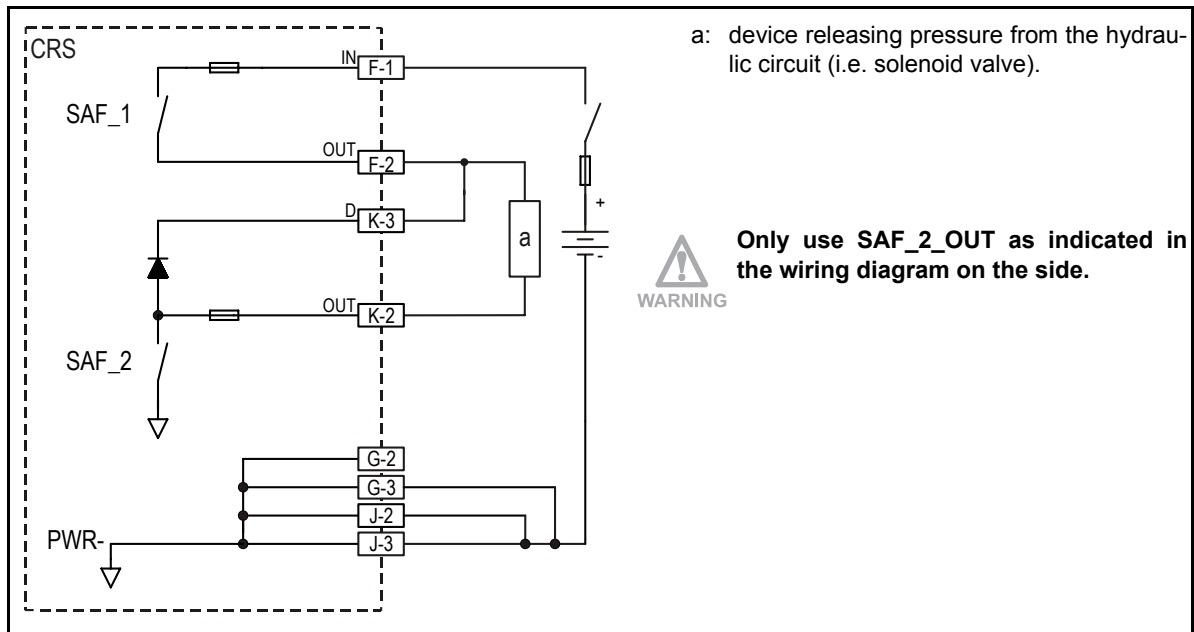
WARNING

When failure is detected on outputs SAF_1 and SAF_2, the STOP circuit automatically opens within 200 ms. Risk analysis must consider this delay.

Wiring of outputs SAF_1 and SAF_2 is the factor that defines the safety level for the UMFS protection function.

7.1 UMFS function complying with cat. 3 PL=d and SIL 2

The UMFS safety function meets the requirements of cat. 3 and PL=d according to the EN ISO 13849-1 and of SIL 2 according to the EN IEC 62061 only if SAFETY outputs enable the device that releases pressure from the machine's hydraulic circuit. Wiring shall be as follows:



WARNING

The installer or the machine manufacturer is in any case responsible for carrying out wiring in such a way as to ensure the safety level required according to the risk analysis.

8 Power supply

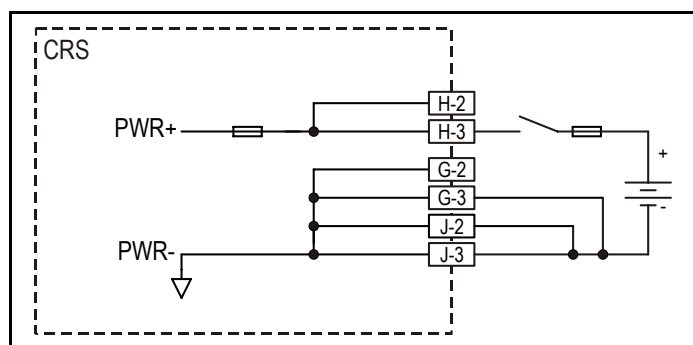
Power on the receiving unit through a battery or a power supply unit with safety isolating transformer, and always respect technical data.

Power supply must be protected against short circuits.

The power supply must have a switch that allows power supply disconnection during installation, wiring and/or maintenance operations. Connect the receiving unit immediately downstream of the machine main switch or of the electrical panel main switch.

8.1 Wiring power supply

Connect power supply to the receiving unit as follows:



9 CAN BUS

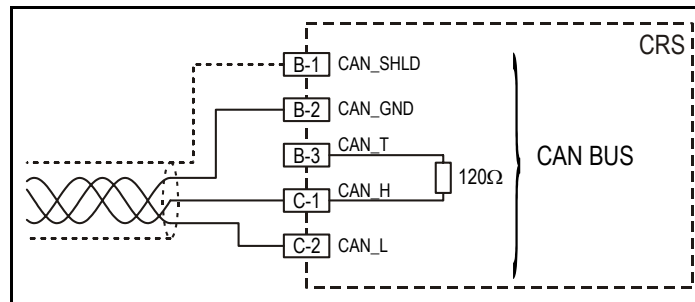
The CAN BUS port is used to connect the receiving unit in a network that communicates through CANopen® protocol.

9.1 Wiring the CAN network

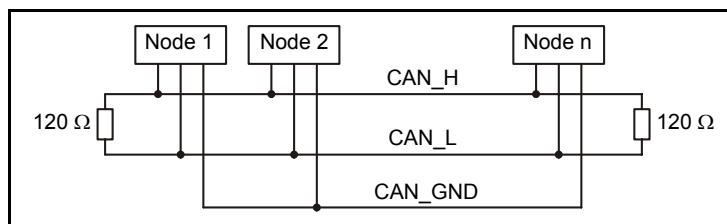
Use CAN_H and CAN_L to wire the CAN network.

Use CAN_GND to wire GND of CAN network.

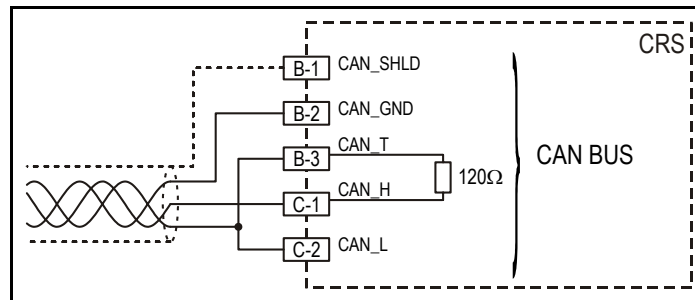
A coiled and shielded cable should be used. In this case, use CAN_SHLD to wire the shield.



Both ends of CAN networks must be terminated with a 120 Ω resistor between CAN_H and CAN_L.



If the CRS receiving unit is at the beginning or at the end of the network, connect outputs CAN_T and CAN_L so that the line termination is connected.

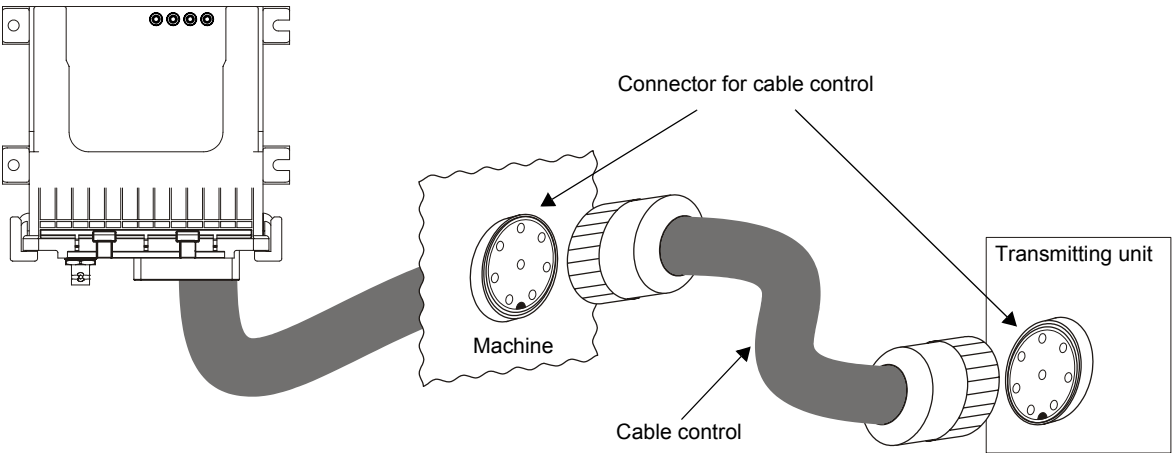


All CAN network nodes must have the same bit rate. The bit rate defines the maximum length for the network:

Bitrate [kbit/s]	1000	800	500	250	125	100	50	20	10
Approximate network length [m]	30	50	100	250	500	600	1000	2500	5000

10 Cable control

The cable control is used to connect the transmitting unit to the receiving unit through a cable, that replaces the radio link. To connect the cable, the corresponding connectors on the transmitting unit and on the machine must be present.



10.1 Wiring the cable control's connector

Install the provided connector on the machine and connect it to the CRS unit as shown below.

