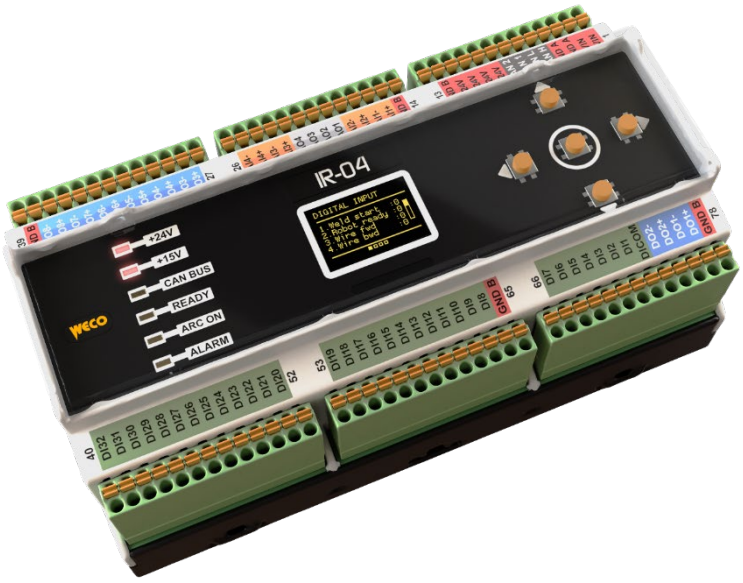
WELD THE WORLD

Robot IR04 Interface

Installation Manual

ENGLISH
Translation of original instructions



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CONTENTS

1 INTRODUCTION

IMPORTANT!
For your safety

This handbook must be consigned to the user prior to installation and commissioning of the unit.
Read the manual "GENERAL INSTRUCTIONS FOR USE" provided separately from this manual before installation and commissioning of the equipment.
The meaning of the symbols in this manual and the associated precautionary information are given in the "GENERAL INSTRUCTIONS FOR USE".
If the "GENERAL INSTRUCTIONS FOR USE" are not present, it is mandatory to request a replacement copy from the manufacturer or from your dealer.
Retain these documents for future consultation.

1.1 MEANING OF THE SYMBOLS

DANGER!

This pictogram warns of danger of death or serious injury.

WARNING!

This pictogram warns of a risk of injury or damage to property.

CAUTION!

This pictogram warns of a potentially hazardous situation.

NOTICE!

This pictogram gives important information concerning the execution of the relevant operations.

1.2 NOTES

The images in this manual are provided for explanatory purposes and may differ from the actual product configuration.

1.3 PRODUCT SPECIFICATIONS

The IR-04 robot interface is a connection board between a remote generator and a PLC-based industrial robot and is designed to be plugged into an automated welding system equipped with a robotic arm. The overall system consists of a current generator, remote control panel, wire feeder trolley and robot interface board.

In TIG, the overall system consists of a current generator and robot interface board.
In MIG, the overall system consists of a current generator, remote control panel, wire feeder trolley and robot interface board.

The robot interface is plugged into the Robot Control cabinet, with which it communicates via digital and analogue inputs and outputs, and consists of an electronic board housed in a plastic enclosure (dimensions 162 x 90 x 60 mm) with DIN rail mountings and push-in spring connectors for wiring to the digital and analogue I/Os of the robot PLC.

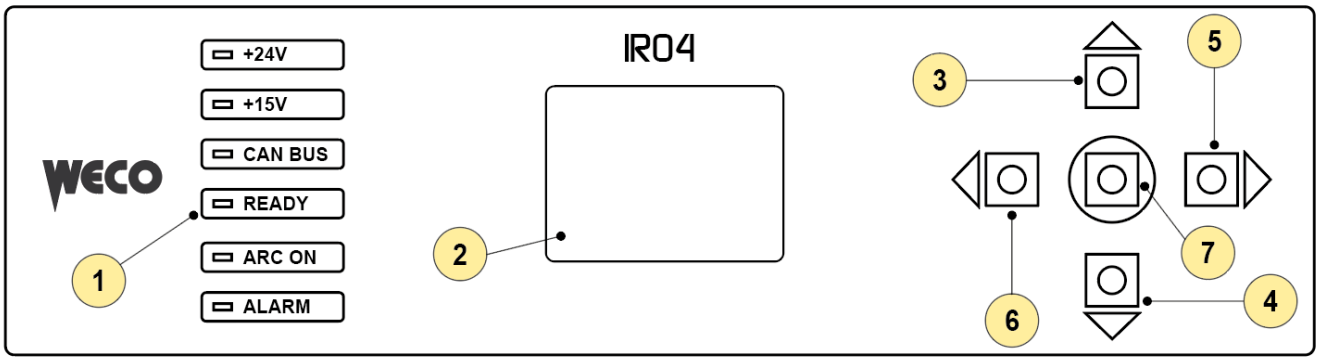
The interface communicates via CAN-bus with the remote panel to which it is wired.

The module must be supplied with +24 V via an external power supply.

2 CONTROL PANEL

The IR04 robot interface is equipped with a control panel from where the operating status of the device can be monitored via the indicator LEDs and the main display.

The main display shows the status of the inputs and outputs and can be used to select the desired information using the navigation keys.



Detail	Function
1	Indicator LEDs (see section 3)
2	Display (see section 5)
3	Navigation key UP ARROW
4	Navigation key DOWN ARROW
5	Navigation key RIGHT ARROW
6	Navigation key LEFT ARROW
7	ENTER key

3 INDICATOR LED

The front panel of the IR04 module features indicator LEDs, which are helpful in informing the user of the operating status of the welding system. The table below lists the indicator LEDs and their use.

NAME	DESCRIPTION
+24 V	LED on: internal 24V power supply is being generated correctly
+15 V	LED on: internal 15V power supply is being generated correctly
CAN BUS	LED on: the IR board is communicating correctly with the machine. LED flashing: BUS communication has been interrupted. LED off: BUS communication is not active.
READY	LED on: machine is ready for operation (no alarms and CAN BUS communication is active)
ARC ON	LED on: arc on. LED off: arc off.
ALARM	LED on: the machine has flagged an error. LED off: no active alarms.

4 ELECTRICAL CONNECTIONS

4.1 TERMINAL NUMBERING

DANGER! **This is a complex device. Installation and commissioning must be carried out by qualified personnel with adequate knowledge of electrical systems.**

Do not install the device where there is live voltage.

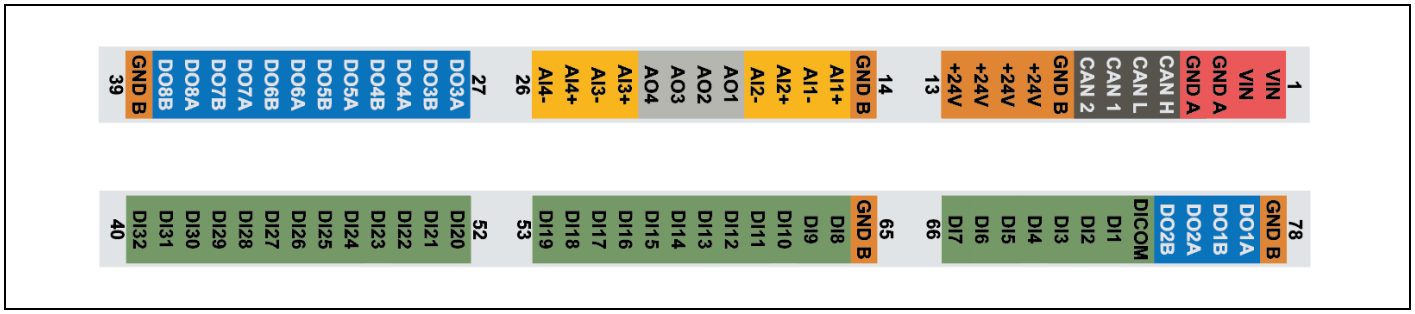
Install the IR04 robot interface inside an electrical panel and fasten it to the fitted DIN rail.

Use the two rows of terminals on the device to carry out the electrical connections.

The board must be powered externally using a 24 V DC voltage, which can supply a current of 1.5 A or greater.

To power the board, connect the external power cable to a VIN - GNDA terminal pair of your choice (e.g. PIN1 and PIN3). The remaining VIN - GNDA terminal pair (PIN2 and PIN4) can be used to supply +24 V power to other circuits.

WARNING! **The supply voltage of the device must be between 20 V and 28 V.**

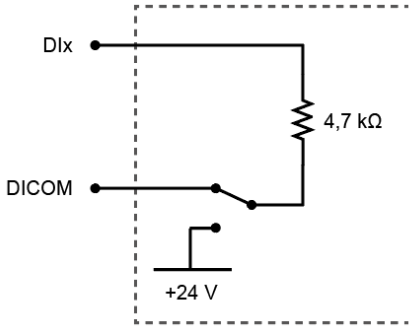
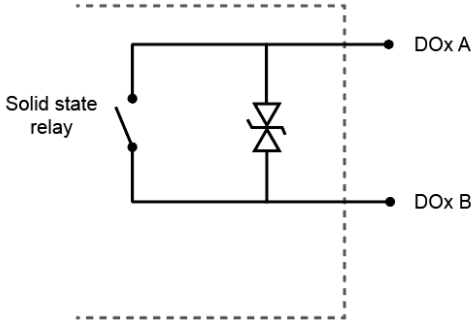


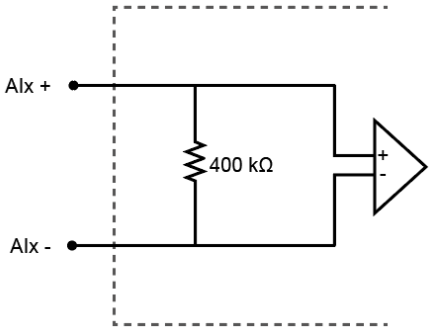
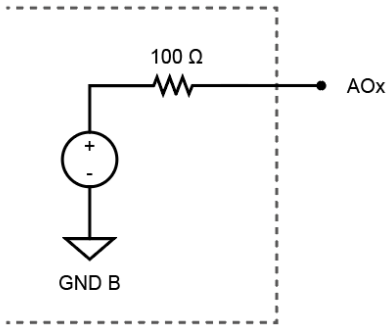
PIN	COLOUR	NAME	DESCRIPTION
1-2	Red	**VIN**	Positive of supply voltage (24V)
3-4	Red	**GND A**	Ground-referenced supply voltage
5	Black	**CAN H**	CAN H communication signal (see section 4.3)
6	Black	**CAN L**	CAN L communication signal (see section 4.3)
7	Black	**CAN1**	CAN 1 auxiliary signal (see section 4.3)
8	Black	**CAN2**	CAN 2 auxiliary signal (see section 4.3)
9	Brown	**GND B**	ROBOT Reference
10 - 13	Brown	**+24 V**	24 V output (maximum current: 250 mA totalling all ports)
14	Brown	**GND B**	ROBOT Reference
15 - 18	Yellow	**AI1 – AI2**	Analogue inputs (differential signal measured between + and -, respectively)
19 – 22	Grey	**AOx**	Analogue outputs
23 - 26	Yellow	**AI3 – AI4**	Analogue inputs (differential signal measured between + and -, respectively)
27 - 38	Blue	**DOx**	Digital outputs (volt-free contact closing between A and B)
39	Brown	**GND B**	ROBOT Reference
40 - 52	Green	**DIx**	Digital inputs (signal referring to DICOM)
53 - 64	Green	**DIx**	Digital inputs (signal referring to DICOM)
65	Brown	**GND B**	ROBOT Reference
66 - 72	Green	**DIx**	Digital inputs (signal referring to DICOM)

PIN	COLOUR	NAME	DESCRIPTION
73	Green	**DICOM**	Digital signal reference (common to all)
74 - 77	Blue	**DOx**	Digital outputs (volt-free contact closing between A and B)
78	Brown	**GND B**	ROBOT Reference

NOTE: the brown +24V and GNB terminals can be used to forward permanently high or low signals to the board inputs.

4.2 VOLTAGE AND CURRENT LIMITS FOR INPUTS AND OUTPUTS

DIGITAL INPUTS	DIGITAL OUTPUTS
	
The voltage between DICOM and each digital input must not exceed ±30 V DC or 30 V AC effective. The frequency of any AC signal placed on a digital input must be between 40Hz and 400Hz.	The voltage with open contact must not exceed ±32 V DC or 25 V AC effective. The current must not exceed ±1.5 A with closed contact.

ANALOGUE INPUTS	ANALOGUE OUTPUTS
	
The voltage must not exceed +15 V or -5 V with respect to GND_B on each input.	The current drawn must be less than 10 mA for each output.

⚠ WARNING! **Observe voltage and current limits for inputs and outputs.**

Power draws or power supplies other than those specified by the manufacturer may result in damage to the internal electronics of the device.

4.3 CONNECTING CAN BUS TO THE GENERATOR

To carry out the Can BUS connection between the IR04 robot interface and the generator, use only the 4-wire cables supplied by Weco.

CODE	DESCRIPTION
002.0001.0462	4-wire CAN BUS connection cable, standard length (5 m)
002.0001.0465	4-wire CAN BUS connection cable, length on request

NOTICE! **Cables other than those specified by the manufacturer may result in malfunctions or communication issues between the interface and the generator.**

The 4-pin connector (A) must be connected to the CAN BUS socket on the generator. The four wires with lugs (B) must be connected to the terminal block on the IR04 robot interface, as per the following diagram:

COLOUR	TERMINAL	DESCRIPTION
Yellow	5	CAN H
Green	6	CAN L
White	7	CAN 1
Brown	8	CAN 2

4.4 DIGITAL INPUTS

The board's digital inputs are grouped in the green terminals.

The digital inputs have the following specifications:

- Insulated and bi-directional
- Option to work with inverted logic (active low).
- Option to work with DC or AC signals (at mains frequency)
- Switching from low to high state is achieved by applying a DC voltage of at least 8 V or an AC signal with a peak value of at least 8 V.
- Option to enable a 24 V pull-up with reference to GND_B (helpful when robot side has volt-free contacts).

The digital inputs available in the device and a brief description of their operation are shown below.

REF.	NAME	DESCRIPTION	OPERATION (NON-INVERTED LOGIC)
DI1	**Weld start**	Starts/stops the welding process. This must stay active throughout the entire welding process.	0 = welding ends 1 = welding starts
DI2	**Robot ready**	The signal originates from the robot and indicates that it is ready for welding.	0 = robot not ready 1 = robot ready
DI3	**Wire fwd**	Enables wire feed in the torch. This function is available when welding mode is not active. When a short circuit between wire and material to be welded (bonded wire) is detected, wire feed is discontinued.	0 = feed not activated 1 = feed activated
DI4	**Wire bwd**	Enables wire retraction in the torch. This function is available when welding mode is not active.	0 = retraction not activated 1 = retraction activated
DI5	**Gas test**	The signal opens the gas solenoid valve and thus activates gas flow; as long as the signal is active, the gas solenoid valve stays open.	0 = gas test not activated 1 = gas test activated
DI6	**Air test**	The signal opens the air solenoid valve and thus activates air flow; as long as the signal is active, the air solenoid valve stays open.	0 = air test not activated 1 = air test activated
DI7	**Piece search**	Enables the piece search procedure. The robot moves along the welding station and brings the torch tip closer to the workpiece, the welder generates a potential difference between the positive and negative poles. When the wire or sleeve touches the piece, a short circuit occurs which is detected by the generator, which then activates the corresponding output (DO3) to indicate that the piece has been found.	0 = piece search not active 1 = piece search active
DI8	**Par mode**	This signal selects whether the welding settings (parameters) are provided by the robot or the generator.	0 = command from generator 1 = command from robot
DI9	**Job mode**	This signal selects how the welding settings (parameters) are provided. In JOB mode; the robot initiates WeldStart and via the Job Num inputs, a previously created and saved JOB can be called up on the generator to change welding processes and parameters.	0 = robot provides WeldStart, only 2-stroke operation 1 = JOB mode
DI10	**Process 0**	The 4 inputs represent the digits of a binary number which indicates the process to be selected.	See section 4.4.1
DI11	**Process 1**		
DI12	**Process 2**		
DI13	**Process 3**		

REF.	NAME	DESCRIPTION	OPERATION (NON-INVERTED LOGIC)
DI14	Job num 0	The 8 inputs represent the digits of a binary number which indicates the job to be selected.	See section 4.4.2
DI15	Job num 1		
DI16	Job num 2		
DI17	Job num 3		
DI18	Job num 4		
DI19	Job num 5		
DI20	Job num 6		
DI21	Job num 7		
DI22	Sp. F. DP	Activates the special “Double Pulse” function. The special function can be permanently disabled via the Settings menu (see section 5.2.2).	0 = function deactivated 1 = function activated
DI23	Sp. F. KDEEP	Activates the special “KDEEP” function. The special function can be permanently disabled via the Settings menu (see section 5.2.2).	0 = function deactivated 1 = function activated
DI24	Sp. F. DSI	Activates the special “DSI” function. The special function can be permanently disabled via the Settings menu (see section 5.2.2).	0 = function deactivated 1 = function activated
DI25	Alarm in	This signal is activated when a generic alarm condition arises in the robot. The signal remains active until the underlying cause of the alarm is removed.	0 = no alarm 1 = presence of alarms
DI26	Alarm reset	Function that clears the alarm signals present in the generator.	0 = function deactivated 1 = function activated
DI27	Simulate in	Activates the simulation function: the user can follow a welding route that has been programmed into the robot without any actual welding taking place.	0 = simulation deactivated 1 = simulation activated
DI28	Search mode	With this parameter the search mode for the piece can be set (wire or sleeve).	0 = search with wire 1 = search with sleeve
DI29	Quick stop	When activated, it stops generator operation (Note: for safety reasons, the signal is always active at low and inverted logic operation is not possible).	0 = quick stop deactivated 1 = quick stop activated
DI30	Free	Input not deployed.	-
DI31	Free	Input not deployed.	-
DI32	Free	Input not deployed.	-

4.4.1 PROCESS SELECTION

The following table shows examples of how the digital inputs PROCESS 0 – PROCESS 3 must be set in order to correctly select the welding process.

PROCESS	DECIMAL CODE	PROCESS 3	PROCESS 2	PROCESS 1	PROCESS 0
No process	**0**	0	0	0	0
Pulsed standard	**1**	0	0	0	1
Short standard	**2**	0	0	1	0
Pulsed HC	**3**	0	0	1	1
Short power focus	**4**	0	1	0	0
Short power root	**5**	0	1	0	1
MIG manual	**6**	0	1	1	0

4.4.2 JOB SELECTION

The following table shows examples of how the digital inputs JOB NUM 0 – JOB NUM 7 must be set in order to correctly select the welding job.

JOB	DECIMAL CODE	JOB NUM 7	JOB NUM 6	JOB NUM 5	JOB NUM 4	JOB NUM 3	JOB NUM 2	JOB NUM 1	JOB NUM 0
Error Job Absent	**0**	0	0	0	0	0	0	0	0
JOB 1	**1**	0	0	0	0	0	0	0	1
JOB 2	**2**	0	0	0	0	0	0	1	0
JOB 3	**3**	0	0	0	0	0	0	1	1
…	**…**	…	…	…	…	…	…	…	…
…	**…**	…	…	…	…	…	…	…	…
…	**…**	…	…	…	…	…	…	…	…
JOB 253	**253**	1	1	1	1	1	1	0	1
JOB 254	**254**	1	1	1	1	1	1	1	0
JOB 255	**255**	1	1	1	1	1	1	1	1

4.4.3 WORKING MODE

When communication is online and inputs and outputs have been managed, parameter, job and process flows must be managed to begin the welding process.

Four working modes are available, which can be used by taking advantage of the bits described in the following table.

MOD.	ROBOT	GENERATOR	Par mode DI8	Job mode DI9	Job num DI14 – DI21	Process DI10 – DI13
A	Weld start	Welding parameters	0	0	0	0
B	Process Weld start Welding parameters	-	1	0	0	1 – 6
C	Weld start Job number	Job	1	1	1 – 255	0
D	Job number Weld start Welding parameters	Job	1	0	1 – 255	0

In mode A, the robot only controls the start and stop of welding. All settings and welding parameters are set exclusively by the welder control.

In B mode, the robot controls the start and stop of welding, process selection, and even welding parameters (wire speed, arc correction, dynamics, wire retraction).

In mode C, the robot controls the start and stop of welding and can select the JOB number, which will define all welding parameters. JOBs must be created and saved in advance inside the generator.

In D mode, the robot controls the start and stop of welding and can select the JOB number to predefine the process and other machine parameters. JOBs must be created and saved in advance inside the generator, but they do not include the welding parameters, which are handled by the robot.

4.4.4 PULL-UP OPERATION ON DIGITAL INPUTS

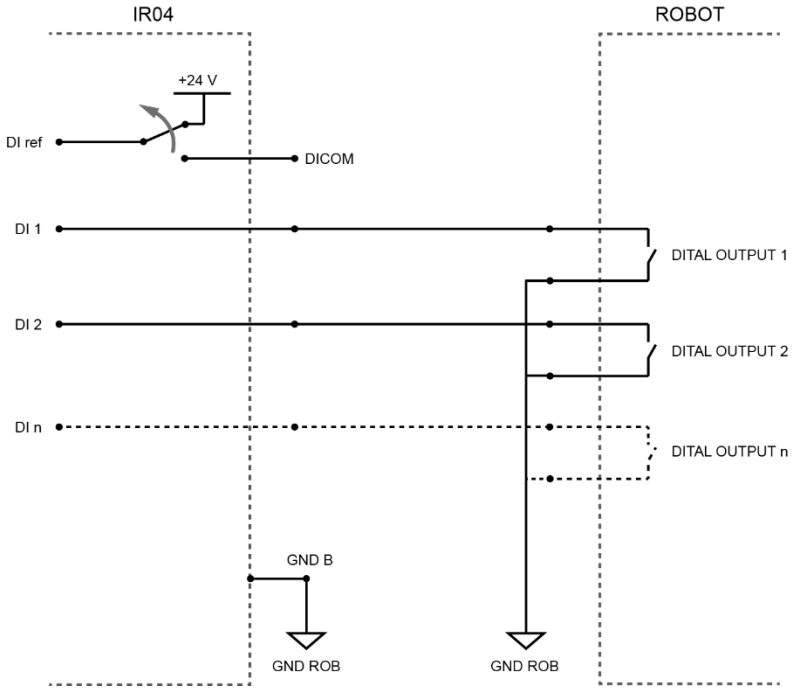
For optimum flexibility, the digital inputs have been implemented in a bidirectional, insulated manner.

To activate an input, simply apply a DC positive or negative voltage greater than 8V, or an AC voltage greater than 8V RMS, between the corresponding pin on the terminal and the DICOM pin (see section 4.4). The DICOM pin can be constrained to any potential in order to achieve the desired effect (including robot reference GND_B).

If the robot uses volt-free contacts, the Pull-Up function can be activated, whereby the DICOM terminal is automatically connected to the internal +24 V (referring to GND B).

In this way, to activate a digital input, the robot simply closes the corresponding terminal to the robot reference (GND B). Should it be necessary, it is always possible to reverse the logic of the module inputs.

To activate the Pull-Up function and the inversion of the input operating logic, see section 5.2.1.



4.5 DIGITAL OUTPUTS

The board's digital outputs are grouped in the blue terminals.

The digital outputs have the following specifications:

- Option to work with inverted logic
- Volt-free NO contact (solid-state relay) output between terminals A and B.
- Bidirectional, with the option to handle AC signals.

REF.	NAME	DESCRIPTION	OPERATION (NON-INVERTED LOGIC)
DO1	**Alarm**	The signal notifies the robot that an alarm has been triggered on the current generator. This stays active until the underlying cause of the alarm is removed.	0 = no alarm 1 = presence of alarms
DO2	**Arc stable**	The signal is activated after the electrode has touched the piece and the welding arc has been switched on and stabilised – the robot can then proceed with the execution of the programme. If a signal does not reach the robot, the programme is not executed. The signal is deactivated when the start signal is switched off, alarms occur during welding, or the end of the welding wire is reached.	0 = arc not stable 1 = arc stable
DO3	**Piece found**	The signal indicates that following a piece search procedure, a piece has been found.	0 = piece not found 1 = piece found
DO4	**Ready**	The signal indicates that the generator is ready for welding.	0 = generator not ready 1 = generator ready
DO5	**Simulate out**	The signal indicates that the simulation process has been activated.	0 = simulation not active 1 = simulation active
DO6	**Wire stuck**	The signal indicates that the wire has stuck to the piece at the end of welding.	0 = wire not stuck 1 = wire stuck
DO7	**Param error**	Signals an inconsistency in the set parameters. For example: ▪ a process and a job are to be set up at the same time ▪ the selected process does not exist ▪ the selected job does not exist ▪ The functions KDEEP or DSI are activated in a process other than the pulsed HC	0 = no error 1 = errors present
DO8	**Free**	Not deployed.	-

4.6 ANALOGUE INPUTS

The board's analogue inputs are grouped in the yellow terminals.

The analogue inputs have the following specifications:

- Differential signal measured between + and - terminals
- Full scale adjustable between 10V and 14V
- Option to disable the reading of unused inputs

REF.	NAME	DESCRIPTION
AI1	**Wire feed rate**	Wire speed (in the range 0-25 m/min)
AI2	**Arc length**	Arc length (in the range -100 +100 or 10-45V for manual MIG welding)
AI3	**Dynamic**	Arc dynamics/inductance (in the range -100 +100)
AI4	**Free**	Not deployed.

4.7 ANALOGUE OUTPUTS

The board's analogue outputs are grouped in the grey terminals.

The analogue outputs have the following specifications:
- Full scale adjustable between 10 V and 14 V.

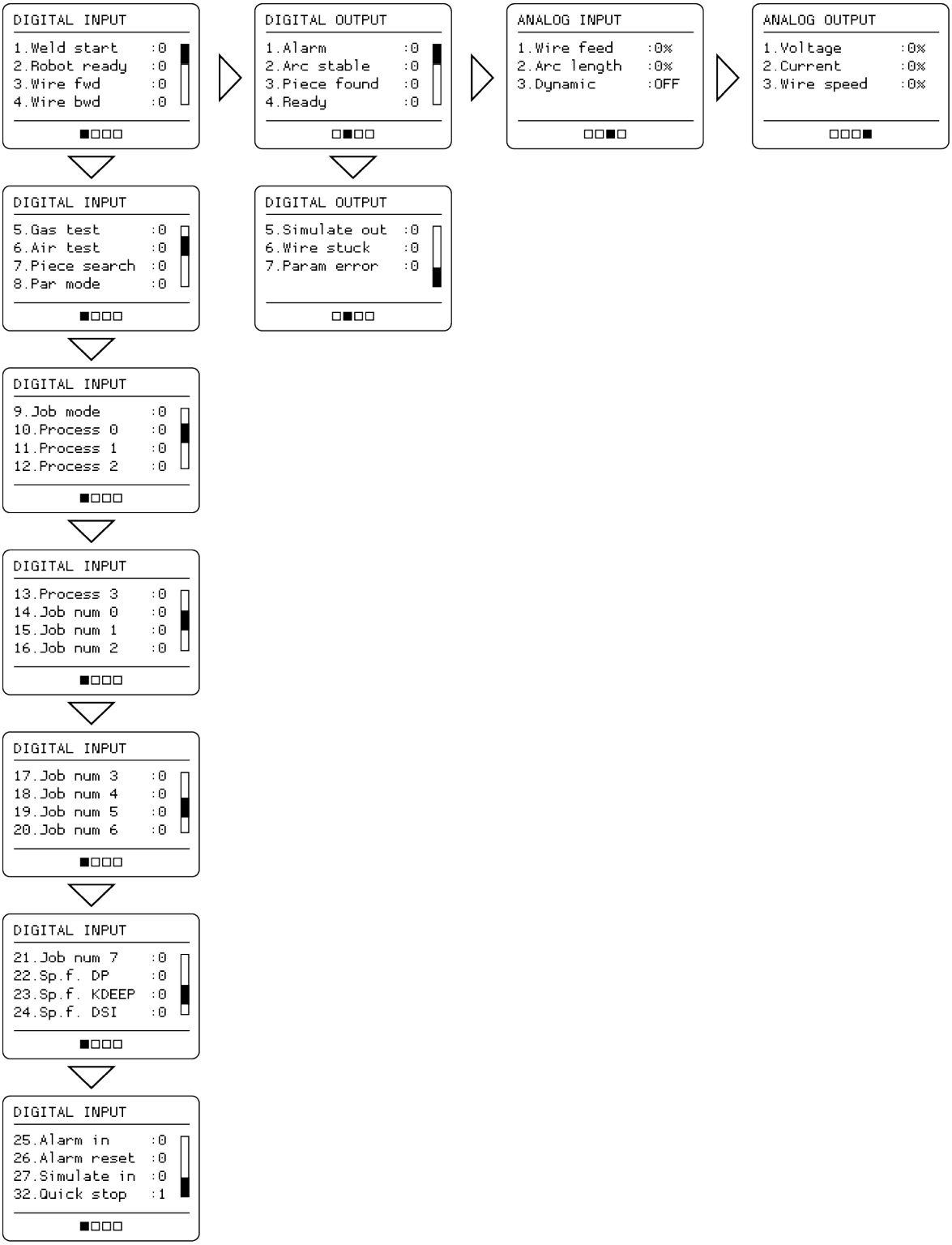
REF.	NAME	DESCRIPTION
AO1	**Voltage**	Welding voltage measurement (in the range 0 - 80 V)
AO2	**Current**	Welding current measurement (in the range 0 - 600 A)
AO3	**Wire speed**	Wire speed measurement (in the range 0 - 25 m/min)
AO4	**Free**	Not deployed.

5 DISPLAY FEATURES

The main display allows the status of the module's inputs and outputs to be viewed and certain board settings to be changed.

5.1 INPUT AND OUTPUT DISPLAY

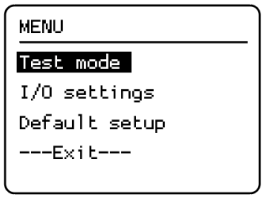
When the module is switched on, the display shows the list of digital and analogue inputs and outputs, with their current status and identification number.
Press the RIGHT ARROW and LEFT ARROW keys to change the category of inputs and outputs displayed in the following order: Digital Input, Digital Output, Analogue Input, Analogue Output.
Press the UP ARROW and DOWN ARROW keys to scroll up or down the list.



5.2 SETTINGS MENU

Holding down the ENTER key will take you to the settings menu where you can change the following items:

- Test mode
- I/O settings
- Default setup

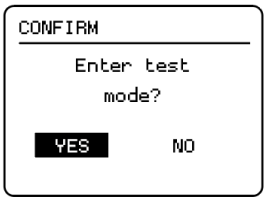


To exit the menu screen, select “Exit” and press the ENTER button.

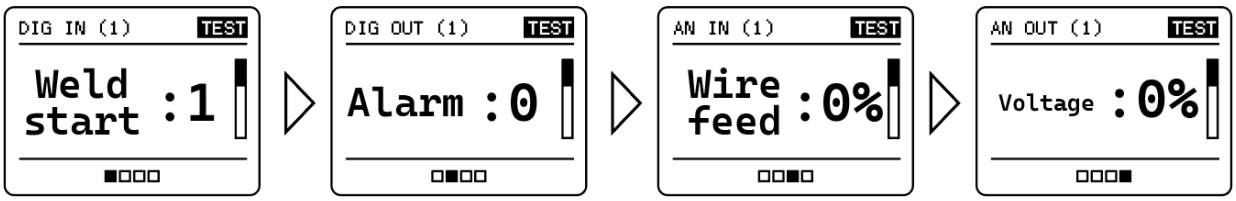
5.2.1 TEST MODE

By activating test mode, CAN communication with the generator is interrupted and the user can manually activate the different outputs and monitor the behaviour of the inputs.

Select “Test mode” and press the ENTER key, a confirmation message is displayed. Select “YES” and press the ENTER key.



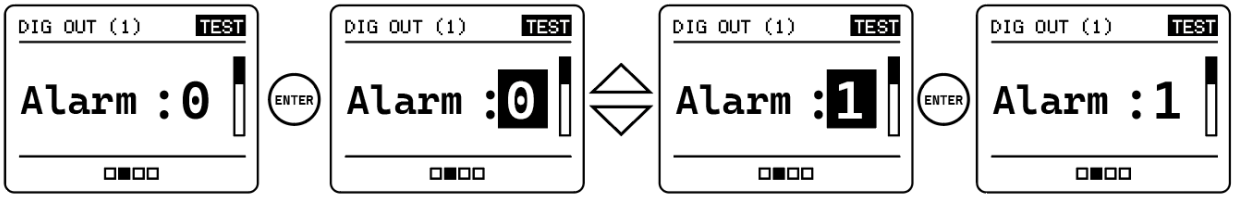
Once test mode has been activated, the following screens appear, displaying the module's inputs and outputs.



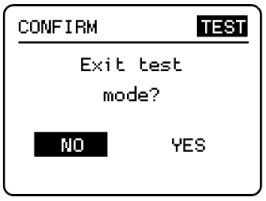
Press the UP ARROW and DOWN ARROW keys to scroll up or down the list: the number of the input or output increases by one unit at a time (e.g: DIG IN (1), DIG IN (2), DIG IN (3), etc.)

Press the RIGHT ARROW and LEFT ARROW keys to change the category of inputs and outputs displayed in the following order: DIG IN (digital inputs), DIG OUT (digital outputs), AN IN (analogue inputs), AN OUT (analogue outputs).

To edit the status of an output, select the desired output using the navigation keys and then press the ENTER button: the output parameter is highlighted.
Set the desired value for the parameter by pressing the UP ARROW or DOWN ARROW keys, then press the ENTER key to exit edit mode: the parameter is no longer highlighted and is now set with the value entered by the user.

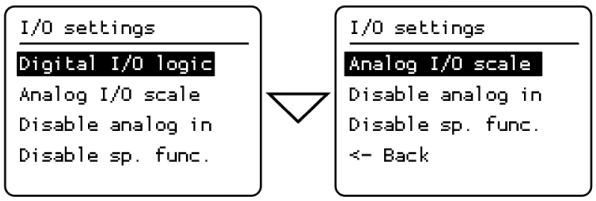


Press and hold the ENTER key to exit test mode: a confirmation message is displayed. Select “YES” and press the ENTER key.



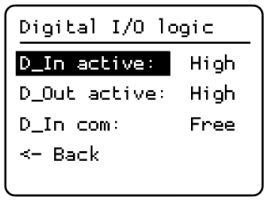
5.2.2 I/O SETTINGS

The way in the inputs and outputs behave can be set using this screen.
Select the item “I/O settings” and press the ENTER key, the following submenus appear.



FUNCTIONAL LOGIC OF DIGITAL INPUTS AND OUTPUTS

By selecting the **“Digital I/O logic”** item and pressing the ENTER key, it is possible to invert the logic (active high or active low) of all digital inputs (except “Quick stop”) and all digital outputs, as well as activate the pull-ups on the digital inputs.



The available options are:

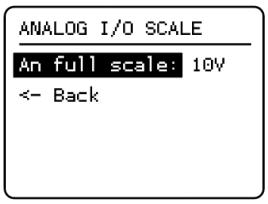
- **D_In active:** allows the activation logic of the digital inputs to be set (high or low).
- **D_Out active:** allows the activation logic of the digital outputs to be set (high or low).
- **D_in com:** allows the pull-ups on the digital inputs to be activated (see section 4.4.4), the available options are:
  - “Free”: to activate an input, simply apply a positive or negative voltage greater than the threshold voltage between the corresponding pin on the terminal and the DICOM pin.
  - “+24V”: the DICOM terminal is automatically connected to the internal +24V (connected to GND B).

To edit a parameter, proceed as follows:

a) Select the parameter from the list using the UP ARROW and DOWN ARROW keys.
b) Press the ENTER key: the parameter value is highlighted.
c) Select the desired parameter value using the UP ARROW and DOWN ARROW keys.
d) Press the ENTER key: the set value of the parameter takes effect and is no longer highlighted.

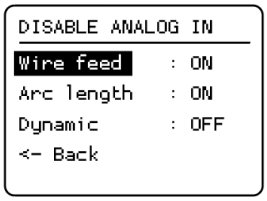
FULL-SCALE ANALOGUE INPUTS AND OUTPUTS

By selecting the **“Analogue I/O scale”** item and pressing the ENTER key, the maximum values of the analogue inputs and outputs can be changed, choosing between the two options 10 V and 14 V.



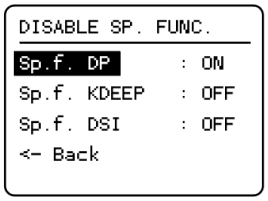
DEACTIVATION OF ANALOGUE INPUTS

By selecting the **"Disable analogue IN"** item and pressing the ENTER key, unused analogue inputs can be disabled.



DEACTIVATION OF SPECIAL FUNCTIONS

By selecting the item **"Disable sp. Func."** and by pressing the ENTER key, unused special functions can be disabled.



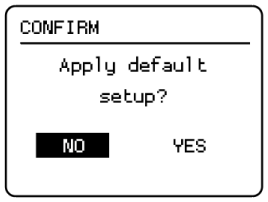
To exit the menus, select "Back" and press the ENTER key.

5.2.3 DEFAULT SETUP

The module can be reset to the default factory settings on this screen:

- Active digital inputs and outputs high
- full scale of analogue inputs and outputs at 10 V
- pull-ups of digital inputs deactivated
- all analogue inputs disabled
- all special functions enabled

Select the item "Default setup" and press the ENTER key: a confirmation prompt appears.
Select "YES" and press the ENTER key to reset the module to the default factory settings.
Select "NO" and press the ENTER key to return to the previous screen, keeping the current module settings.



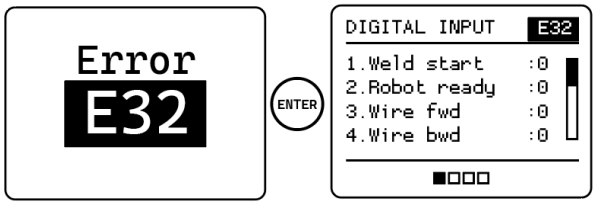
5.3 STAND-BY

The display automatically switches off when not in use. To reactivate it, simply press any key.

5.4 ERROR REPORTING

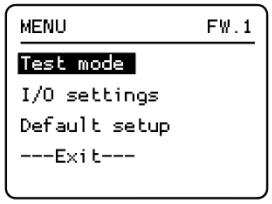
When the current generator reports an error, the corresponding code is also shown on the display of the IR04 robot interface.

Pressing the ENTER key allows you to exit the error screen and navigate through the menus; the error code remains in the upper right display until the error is reset in the welding current generator.

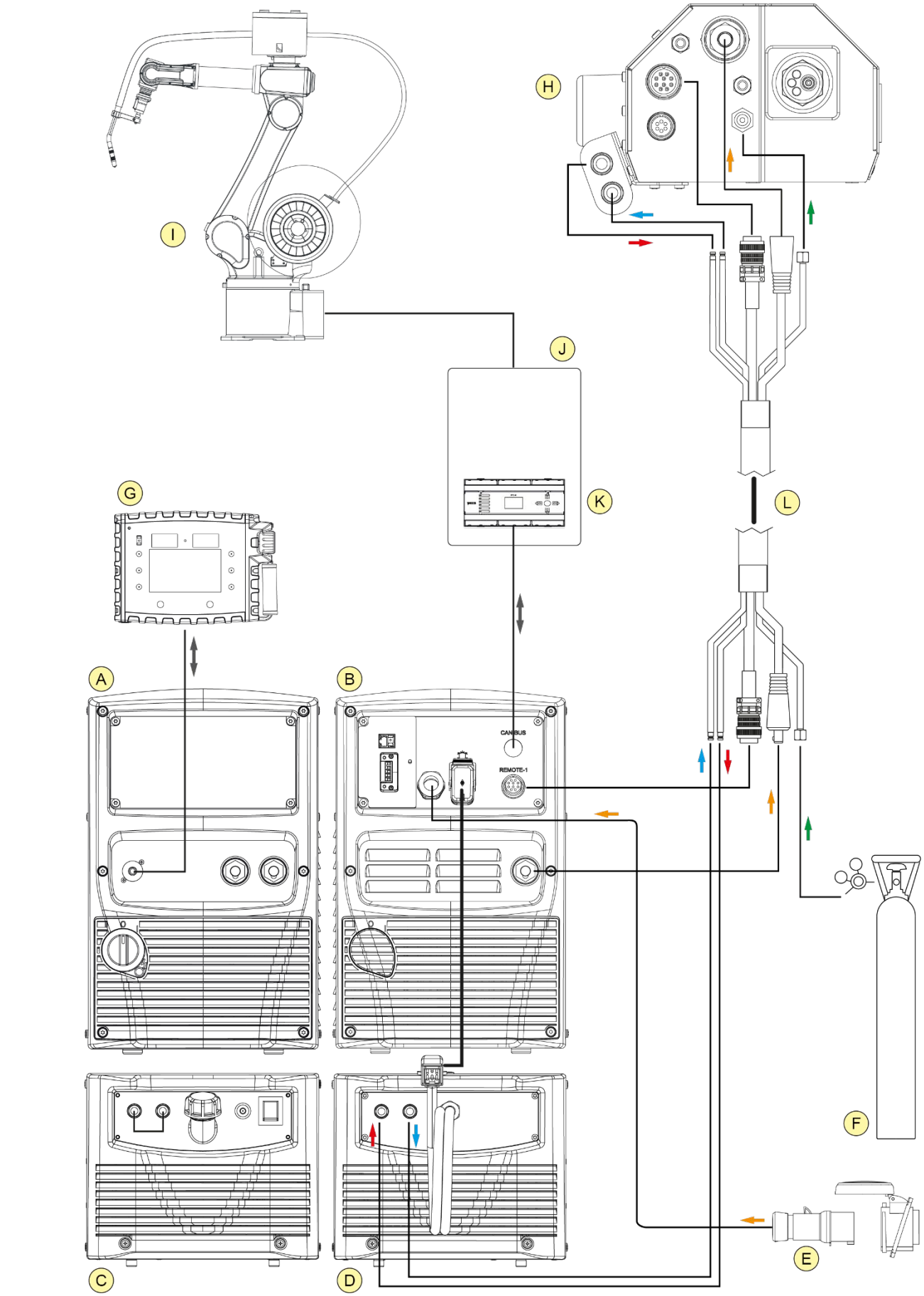


5.5 FIRMWARE VERSION

The firmware version installed on the module is displayed on the main page in the settings menu, in the top right-hand corner.
To access the settings menu, hold down the ENTER key (see section 5.2)



6 MIG WELDING SYSTEM ASSEMBLY



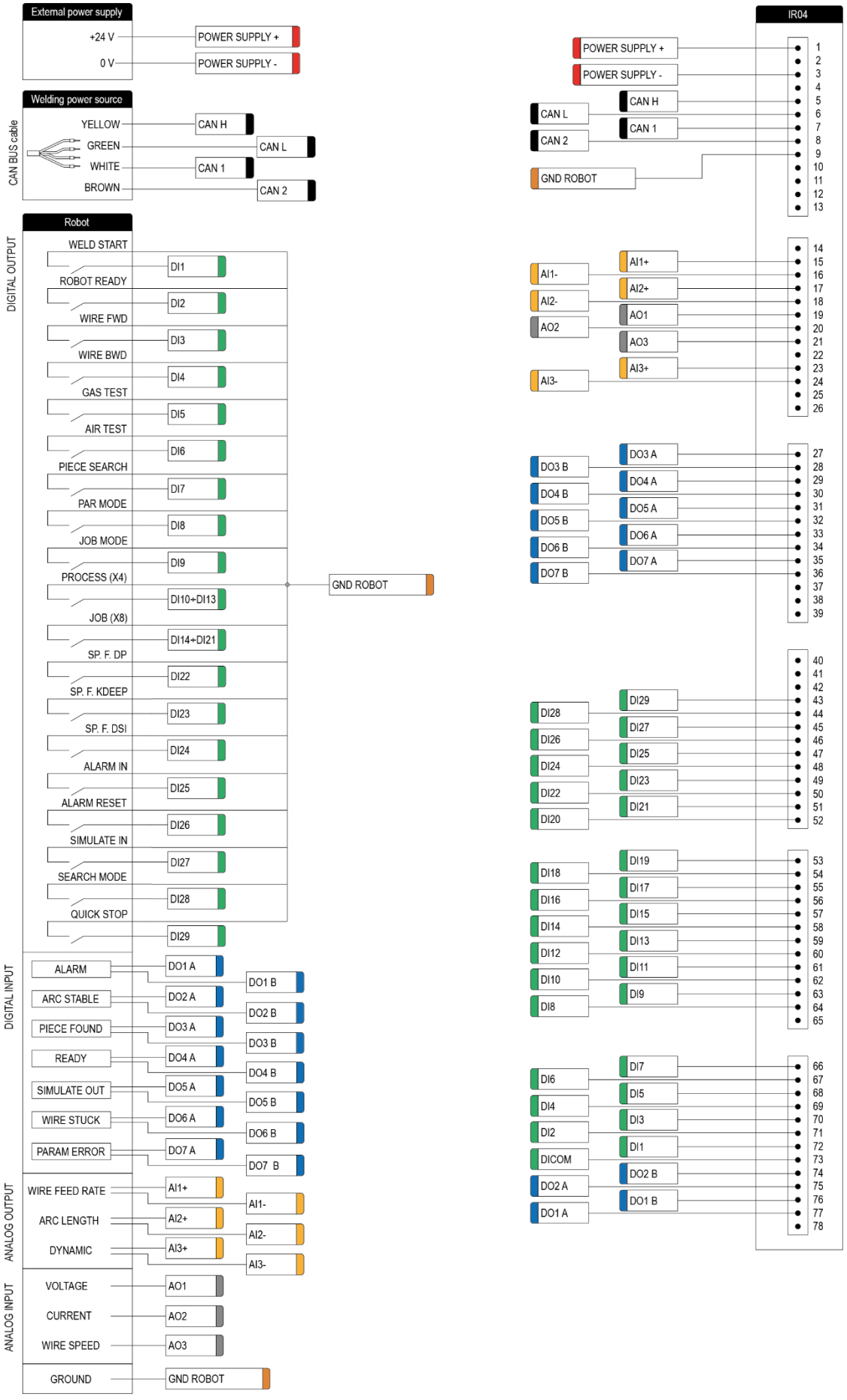
List of components

- **A** Generator (front view)
- **B** Generator (rear view)
- **C** Cooling unit (front view)
- **D** Cooling unit (rear view)
- **E** Power supply socket
- **F** Gas cylinder
- **G** Remote control
- **H** Wire feeder unit
- **I** Welding robot
- **J** Robot control cabinet (PLC)
- **K** Robot interface
- **L** Cable bundle

Key

- Electric current
- Gas
- Coolant (delivery)
- Coolant (return)
- CAN-BUS line

7 WIRING DIAGRAM



NOTICE!

The electrical wiring diagram provided refers to the following configuration:

- **robots with digital relay outputs;**
- **robot with digital inputs capable of interpreting an open/closed contact type signals;**
- **robot with analogue inputs refer to GND_ROB (robot reference);**
- **robots with differential analogue outputs;**
- **IR04 interface set with parameters “D_in COM” = +24V and “D_in ACTIVE” = LOW**

8 SPARES

Please contact the manufacturer of the device in the event of any faults or malfunctions.

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