Instruction book
IQAN-MC2

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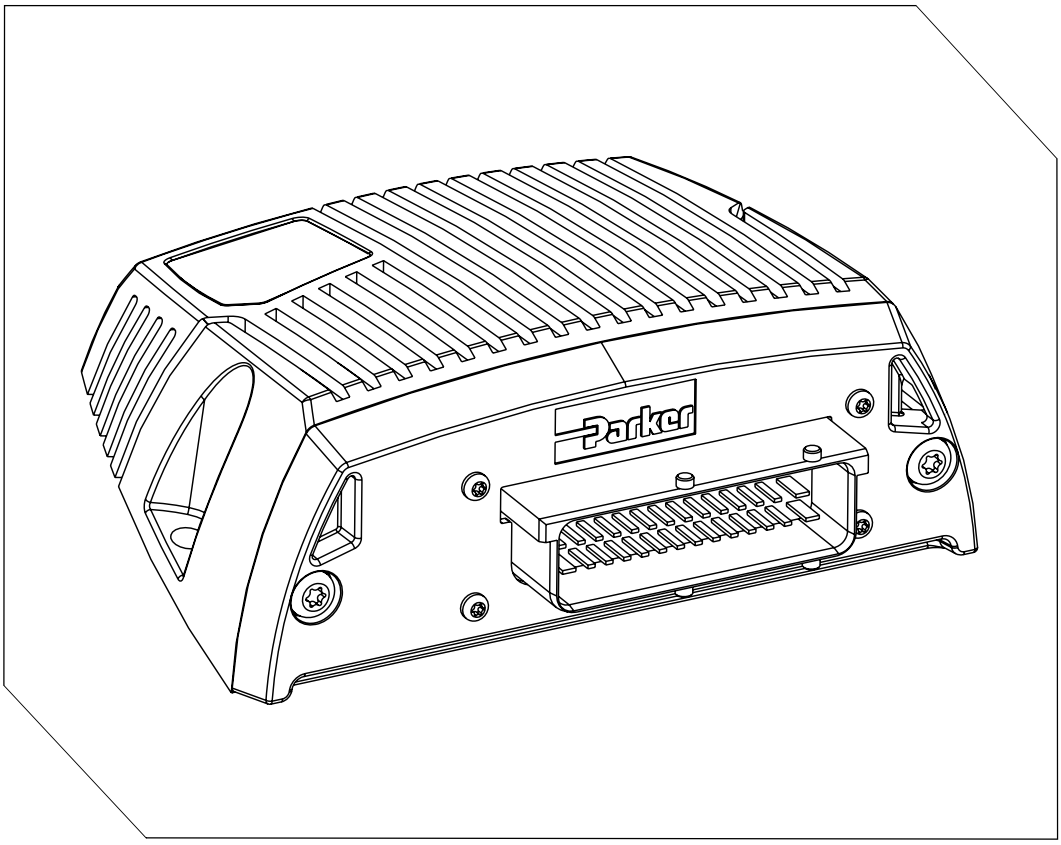

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1 Introduction

These instructions are to be used as a reference tool for the vehicle manufacturer’s design, production, and service personnel.

The user of these instructions should have basic knowledge in the handling of electronic equipment.

Safety symbols

Sections regarding safety, marked with a symbol in the left margin, must be read and understood by everyone using the system, carrying out service work or making changes to hardware and software.

The different safety levels used in this manual are defined below.

WARNING

Sections marked with a warning symbol in the left margin, indicate that a hazardous situation exists. If precautions are not taken, this could result in death, serious injury or major property damage.

CAUTION

Sections marked with a caution symbol in the left margin, indicate that a potentially hazardous situation exists. If precautions are not taken, this could result in minor injury or property damage.

NOTICE

Sections marked with a notice symbol in the left margin, indicate there is important information about the product. Ignoring this could result in damage to the product.

Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.

The term "manufacturer" refers to Parker Hannifin Corporation.

2 Precautions

General safety regulations

Work on the hydraulics control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine and its safety regulations.

WARNING

Mounting, modification, repair and maintenance must be carried out in accordance with the manufacturer's regulations. The manufacturer has no responsibility for any accidents caused by incorrectly mounted or incorrectly maintained equipment. The manufacturer does not assume any responsibility for the system being incorrectly applied, or the system being programmed in a manner that jeopardizes safety.

WARNING

Damaged product may not be used. If the control system shows error functions or if electronic modules, cabling or connectors are damaged, the system shall not be used.

WARNING

Electronic control systems in an inappropriate installation and in combination with strong electromagnetic interference fields can, in extreme cases, cause an unintentional change of speed of the output function.

NOTICE

As much as possible of the welding work on the chassis should be done before the installation of the system. If welding has to be done afterwards, the electrical connections on the system must be disconnected from other equipment. The negative cable must always be disconnected from the battery before disconnecting the positive cable. The ground wire of the welder shall be positioned as close as possible to the place of the welding. The cables on the welding unit shall never be placed near the electrical wires of the control system.

Construction regulations

CAUTION

The vehicle must be equipped with an emergency stop which disconnects the supply voltage to the control system's electrical units. The emergency stop must be easily accessible to the operator. The machine must be built if possible, so that the supply voltage to the control system's electrical units is disconnected when the operator leaves the operator’s station.

Safety during installation

CAUTION

Incorrectly positioned or mounted cabling can be influenced by radio signals which can interfere with the functions of the system.

Safety during start-up

WARNING

The machine's engine must not be started before the control system is mounted and its electrical functions have been verified.

Ensure that no one is in front, behind or nearby the machine when first starting up the machine.

Follow the instructions for function control in the Start-up section.

Safety during maintenance and fault diagnosis

CAUTION

Ensure that the following requirements are fulfilled before any work is carried out on the hydraulics control electronics.

- The machine cannot start moving.
- Functions are positioned safely.
- The machine is turned off.
- The hydraulic system is relieved from any pressure.
- Supply voltage to the control electronics is disconnected.

3 Product description

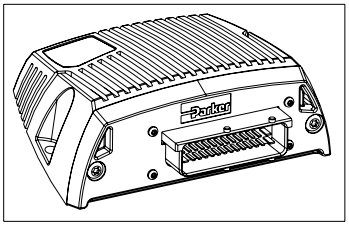
IQAN-MC2

The IQAN-MC2 is designed for controlling hydraulic systems in vehicles and machinery, using 12/24 Vdc power supply.

IQAN-MC2 is a master unit capable of running applications created by IQANdesign. The MC2 has local I/O for input/output use and has two CAN busses that support ICP (IQAN CAN Protocol), SAE J1939 and Generic CAN. As a bus master the MC2 is able to control expansions units XA2, XS2, XT2, Lx and XR.

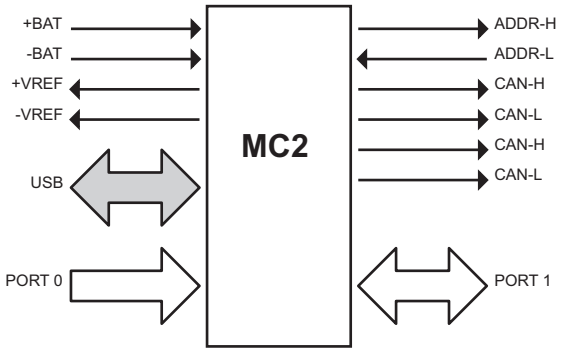
By supporting SAE J1939 and Generic CAN the MC2 can act as a sub-master when there is a need of higher performance in a sub-circuit or when there is an OEM supplied overall machine master.

This product is designed for the outdoor environment and comes with an IP6K9K protection for applications where high-pressure water and steam jet cleaning is used.



The IQAN-MC2 module.

I/O overview



Inputs

The IQAN-MC2 module has eight (5) *voltage inputs* VIN-A thru VIN-E for connection of 0-5 Vdc signals. The inputs are multi-purpose and for flexibility may be configured in other ways. The input pins VIN-A and VIN-E can be configured as *on/off inputs* for switches or as *frequency inputs* for measuring frequency. *Voltage inputs*, *on/off inputs* and *frequency inputs* share positions, see list.

(5) Voltage inputs VIN-A thru VIN-E

or

(5) Frequency inputs FIN-A thru FIN-E use positions VIN-A thru VIN-E.

or

(5) Digital inputs DIN-A thru DIN-E use positions VIN-A thru VIN-E.

Proportional outputs

The MC2 module has eight (8) double *proportional outputs* for controlling proportional valves. These outputs can control eight bi-directional valve sections or eight single solenoid devices (ie. proportional cartridge valves). The proportional outputs can be used in two different modes. Either *Current mode* (current closed loop) or *PWM mode* (voltage open loop) signals can be selected and the parameters configured using IQAN software.

For flexibility these outputs may also be configured as up to eight (8) *on/off outputs* and up to eight (8) *on/off inputs or voltage inputs*. Additional functionality for these positions is as up to sixteen (16) *low-side on/off outputs*. The proportional outputs, on/off outputs, on/off or voltage inputs and low-side on/off outputs share positions, see below.

(8) double proportional outputs COUT-A thru COUT-H

or

(8) double proportional outputs PWMOUT-A thru PWMOUT-H

or

(8) on/off outputs DOUT-A thru DOUT-H.
Each pair of return pins may then be used as:
(2) low-side digital output switches (16) total, DOUT(LS)-I thru DOUT(LS)-X.
It is recommended to use one or more of DOUT-A thru DOUT-H as source if used in this manner, for safety.
The pairs of return pins associated with DOUT-E thru DOUT-H may also be used as:
(2) on/off inputs, (8) total, DIN-F thru DIN-M.
(2) voltage inputs, (8) total, VIN-F thru VIN-M.

In order to increase the performance of the proportional outputs when controlling proportional valves, the *dither frequency* can be adjusted.

CAN related functions

The MC2 uses the CAN-bus (CAN = Controller Area Network) to communicate with the modules. The CAN-bus is a robust communication protocol that is widely used and well proven within the automotive industry.

Communication

The communication interface is used for uploading/downloading applications or diagnostics and typically are connected to a computer.

USB

The IQAN-MC2 has a USB1.1 (device only) connection in connector C1.

4 Safety

General

In order to fulfill the highest safety demands, the MC2 module uses a real-time operating system for fault tolerant embedded systems. The MC2 module has an internal watchdog function. If the RTOS (real time operating system) detects any software errors, necessary precautions will be activated and the watchdog will reset the module.

Polarity reversal

The MC2 module is protected against power supply polarity reversal and over-voltage, provided an external fuse, max 20 A (Fast) is being used.
If this fuse is not used, polarity reversal can damage the unit.

CAN-bus interruption

The MC2 module has special safety functions if the CAN-bus is interrupted. Each module checks for any interruptions in the CAN-bus communication. If an error occurs the master unit's LED will show an appropriate error code ref, section System Diagnostics, on page 8.

Input/ output Protection

All inputs on the MC2 module are designed to withstand the maximum specified supply voltage. The outputs are protected against short circuit. Furthermore, an error on one input/ output will not influence other inputs/outputs.

Current check

For the *proportional outputs* when used in *current mode,* a current check is performed. If an error occurs the master unit's LED will show an appropriate error code ref, section System Diagnostics, on page 8.

The MC2 module can detect open-circuit, short-circuit to +BAT/-BAT or short-circuit to other proportional output and return pins. In these cases the module will shut off the affected output in order to increase safety.

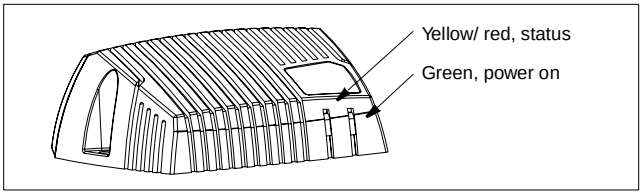
Built-in test

The MC2 module will execute a self-test during operation to verify the hardware and the software.

The test includes CAN- bus verification, memory integrity check and an internal signal verification. If any error is detected appropriate precautions will be activated.

System Diagnostics

The yellow blinking LED on the top of the module indicates normal status. If there is an error detected, the master will present a message on the display. The MC2 module also indicates *error status* through the red blinking LED.
This gives an immediate diagnosis as to the nature of the error that has occurred.



The location of the LED indicators on the IQAN-MC2 module.

The green LED indicates power on. The yellow/red LED, will be blinking red when an error has been detected. To get futher information about the error messages, see Appendix B, on page 33

A small recommendation...

You can use the internal diagnostics in the master to get more information about the MC2 module. The following values are supervised:

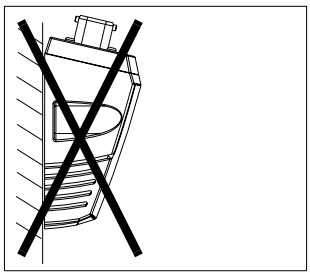
Internal temperature [°C]
Power supply [V]
Reference voltage [V]

5 Mounting

Mounting the module

The IQAN-MC2 module should be mounted according to the following instructions:

- Locate the module eliminating the risk for the cabling to be folded, crushed or damaged in any way. Ensure the cabling cannot pull, twist or induce sideload on the connector.
- Locate the module so that severe physical impact is avoided, e.g impact from falling objects or the module being used as a step.
- Locate the module so that air can circulat to eliminate excess heat. Ensure that no external heat, e.g. from the engine or heater, is transferred to the module.
- Locate the module to protect it from high pressure washing or similar.
- Locate the module so that the cable connector is facing down .
- Locate the module so that the LEDs are visible.



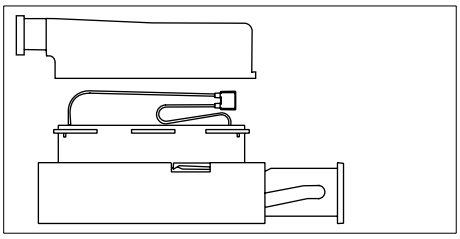
Non approved placing.

NOTICE

The IQAN-MC2 module must not be placed in any marine related or similar continuously damp, salt-spray environment without external protection.

Assembling of the ID-Tag

The ID-Tag will be placed in the connector in order to address/ terminate the module, ref section IQAN-MC2 addressing/terminating, on page 14.
The ID-Tag will be mounted under the connector casing. Bend the ID-Tag’s wires toward the opposite side of where the other wires enter the connector.

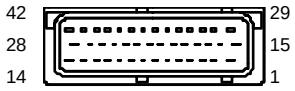


Assembling of the Id-Tag.

6 Installation

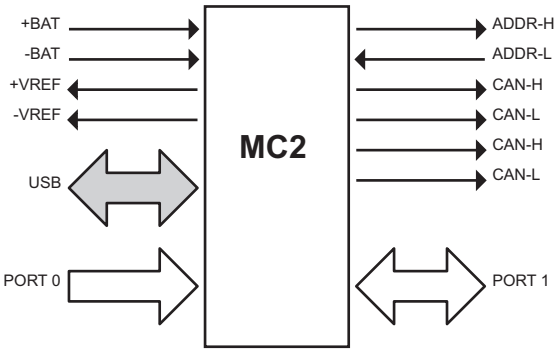
Connector C1

Connector kit	**Parker no. 5031063**	
Housing	Amp no. 1-963226-1	
Casing	Amp no. 0-965643-1	
Plane sealing, 42 p	Amp no. 963225-1	
Pin types*	Amp no. 963711-2 (MT)	Amp no. 929938-1 (JPT)
Cables	0,75-1,0 mm² (MT)	1,5-2,5 mm² (JPT)
Seals	Amp no. 963530-1 (MT)	Amp no. 828905-1 (JPT)
Plugs (empty pos.)	Amp no. 963531-1 (MT)	Amp no. 828922 (JPT)
IQAN crimping tool references	Blue handle, pos. A use blue extraction tool	Red handle, pos. B use yellow extraction tool
IQAN tool kit	Parker no. 5031061	



*= The connector contains two types of terminals; MT (Micro Timer) and JPT (Junior Power Timer).

Connector pin assignments



Symbol	Pin No.	In Out	Function
+BAT	28	-	Power supply
-BAT	15	-	Power supply
+RTC	6	-	Power supply for RTC.
+VREF	42	-	Voltage reference for external sensors. Sourcing +5V.
-VREF	29	-	Voltage reference for external sensors. Return (0V).
ADDR-H	1	-	IdTag interface. High side to address tag. Sourcing +5V.
ADDR-L	14	-	IdTag interface. Low side to address tag. Return signal.

Symbol	Pin No.	In Out	Function				
CAN-A-H	27	-	CAN high voltage bus line, will be HIGH in dominant state.				
CAN-A-L	41	-	CAN low voltage bus line, will be LOW in dominant state.				
CAN-B-H	26	-	CAN high voltage bus line, will be HIGH in dominant state.				
CAN-B-L	40	-	CAN low voltage bus line, will be LOW in dominant state.				
USB-D+	12	-	USB high voltage bus line. USB shield and gnd connects to -VREF or -BAT.				
USB-D-	13	-	USB low voltage bus line. USB shield and gnd connects to -VREF or -BAT.				
P0			P0 is an 5pin input port with alternative functions.				
			VIN	**DIN**	**FIN**		
P0.0	20	I	VIN-A	DIN-A	FIN-A		
P0.1	21	I	VIN-B	DIN-B	FIN-B		
P0.2	34	I	VIN-C	DIN-C	FIN-C		
P0.3	35	I	VIN-D	DIN-D	FIN-D		
P0.4	7	I	VIN-E	DIN-E	FIN-E		
P1			P1 is an 24pin input/output port with alternative functions.				
			COUT	**PWMOUT**	**DOUT**	**VIN**	**DIN**
P1.0	2	O	COUT-A	PWMOUT-A	DOUT-A	-	-
P1.1	16	O/I	RET-A+	RET-A+	DOUT(LS)-I	-	-
P1.2	30	O/I	RET-A-	RET-A-	DOUT(LS)-J	-	-
P1.3	3	O	COUT-B	PWMOUT-B	DOUT-B	-	-
P1.4	17	O/I	RET-B+	RET-B+	DOUT(LS)-K	-	-
P1.5	31	O/I	RET-B-	RET-B-	DOUT(LS)-L	-	-
P1.6	4	O	COUT-C	PWMOUT-C	DOUT-C	-	-
P1.7	18	O/I	RET-C+	RET-C+	DOUT(LS)-M	-	-
P1.8	32	O/I	RET-C-	RET-C-	DOUT(LS)-N	-	-
P1.9	5	O	COUT-D	PWMOUT-D	DOUT-D	-	-
P1.10	19	O/I	RET-D+	RET-D+	DOUT(LS)-O	-	-
P1.11	33	O/I	RET-D-	RET-D-	DOUT(LS)-P	-	-
P1.12	8	O	COUT-E	PWMOUT-E	DOUT-E	-	-
P1.13	22	O/I	RET-E+	RET-E+	DOUT(LS)-Q	VIN-F	DIN-F
P1.14	36	O/I	RET-E-	RET-E-	DOUT(LS)-R	VIN-G	DIN-G
P1.15	9	O	COUT-F	PWMOUT-F	DOUT-F	-	-
P1.16	23	O/I	RET-F+	RET-F+	DOUT(LS)-S	VIN-H	DIN-H
P1.17	37	O/I	RET-F-	RET-F-	DOUT(LS)-T	VIN-I	DIN-I
P1.18	10	O	COUT-G	PWMOUT-G	DOUT-G	-	-
P1.19	24	O/I	RET-G+	RET-G+	DOUT(LS)-U	VIN-J	DIN-J
P1.20	38	O/I	RET-G-	RET-G-	DOUT(LS)-V	VIN-K	DIN-K
P1.21	11	O	COUT-H	PWMOUT-H	DOUT-H	-	-
P1.22	25	O/I	RET-H+	RET-H+	DOUT(LS)-W	VIN-L	DIN-L
P1.23	39	O/I	RET-H-	RET-H-	DOUT(LS)-X	VIN-M	DIN-M
			Note: If a COUT or PWMOUT block (COUT-x/PWMOUT-x, RET-x+, RET-x-) is used, all three pins are configured as COUT (or PWMOUT). *Note: VIN-F to VIN-M (or DIN-F to DIN-M) can only be configured in pairs. Each pair can only be either inputs (VIN, DIN), or outputs (DOUT-LS)* *VIN-F to VIN-M (or DIN-F to DIN-M) are equipped with clamping diodes, risk for "backending".*				

Shaded positions are Junior Power Timer pins. Unshaded positions are Micro Timer pins. See above for wire, seal, pin number and crimping tool information. The IQAN tool kit is found in the 'IQAN accessories' datasheet.

Supply voltage

Before any installation of the IQAN system can take place, make sure the ignition lock is turned off and the battery is disconnected.

Emergency stop

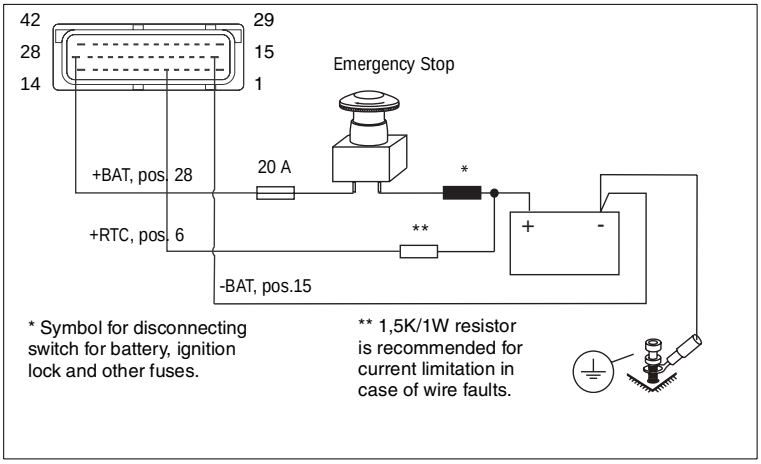
Make sure an *Emergency Stop* disconnecting the power supply, is easily accessible at any time. Further relevant regulations are to be found in Machinery Directives 9837/EC. The figure below shows how to connect the emergency stop.

Connecting of Supply Voltage

The supply voltage, should be within the operating interval, see Appendix A, on page 29. Connect the supply voltage to +BAT, position 28 and -BAT, position 15. Protect the module by using a fuse. Requisite fuse level should be 20 A, fast (F).

The *real time clock*, +RTC, requires a separate positive power connection. To reduce the risk for uncontrolled supply of the unit, i.e short circuit between +RTC cable and other cables, a resistor must be connected between the battery and the +RTC input. This is important as this supply line is not controlled by the emergency stop.

The resistor should be placed as close to the battery as possible to protect cables between the resistor and the unit. Parker address tag 5030043 (address 3) could be used since it has an encapsulated 1.5K ohm resistor.



Connecting the emergency stop and voltage supply.

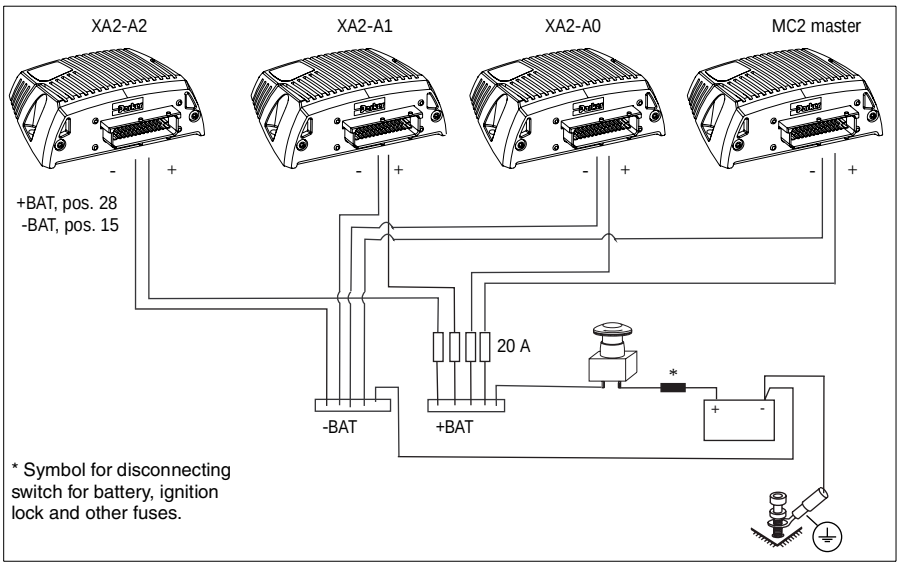
NOTICE

Do not use the chassis as the negative terminal.

Multiple modules connected to voltage supply

When connecting several modules, all of the units will have to be separately connected to the battery voltage and each unit protected with a fuse. Requisite fuse level should be 20 A, fast (F).

EXAMPLE



Connecting several modules to the power supply.

IQAN-MC2 addressing/terminating

Use of an ID-Tag

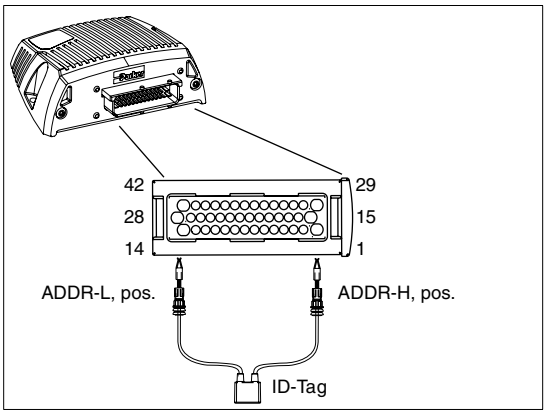
Each MC2 module can be configured by using an *ID-Tag*. The value of the ID-Tag will enable specific functions in the MC2 module if supported in an IQANdesign application file. This allows a single master application to be loaded into more than one MC2 and the functionality needed for the installed location is enabled by ID-tag. By default, if no ID-tag is installed the MC2 will be terminated internally to be the Bus master and will have no special configuration.

Configuration by address

Connection of an ID-Tag between address high and low will enable a numeric input to the application file in the MC2 master module. The desired functionality is built into the application file using IQANdesign software. For more information please refer to the IQANdesign user manual. For normal operation the ID-Tag is not used. It is only needed when a function has been implemented in the application file by using the address as an input.

EXAMPLE
If having an MC2 module with an ID-Tag of address 0, the system will recognize a value of 0 to the application which will enable a user- specified functionality.

The maximum number of addresses is eight, denoted as addresses 0, 1, 2, 3, 4, 5, 6, 7 respectively. In order to assign any MC2 module a unique address, an *ID-Tag* will have to be connected to the positions ADDR-H and ADDR-L.



Connecting of Id-Tag.

Terminating

To eliminate interference in the communications through the CAN-bus, the CAN-bus must be terminated. By default, if no ID-tag is installed the MC2 will be terminated internally to be the Bus master and will have no special configuration.

If an IQAN-MC2 is located at the end of the CAN-bus and is to be configured by address, then use an ID-tag having a combined address and terminating function. This is denoted with a "T" for terminating, after the appropriate address such as; 0T, 1T, 2T... etc. In the application, the same address value as the non-terminated ID-Tag with equivalent number will be transferred to the application.

Selecting appropriate ID-Tag

- If an *ID-tag* is needed, check the address number used for the module.
- If the module is to be configured and is located at the end of the CAN-bus, then select the appropriate *ID-Tag* denoted with a "T".

NOTICE

The CAN-bus must not be terminated at the MC2 using an external regular terminating resistor, due to the fact that terminating is made from within the MC2 module by default or in conjunction with the *ID-Tag*.

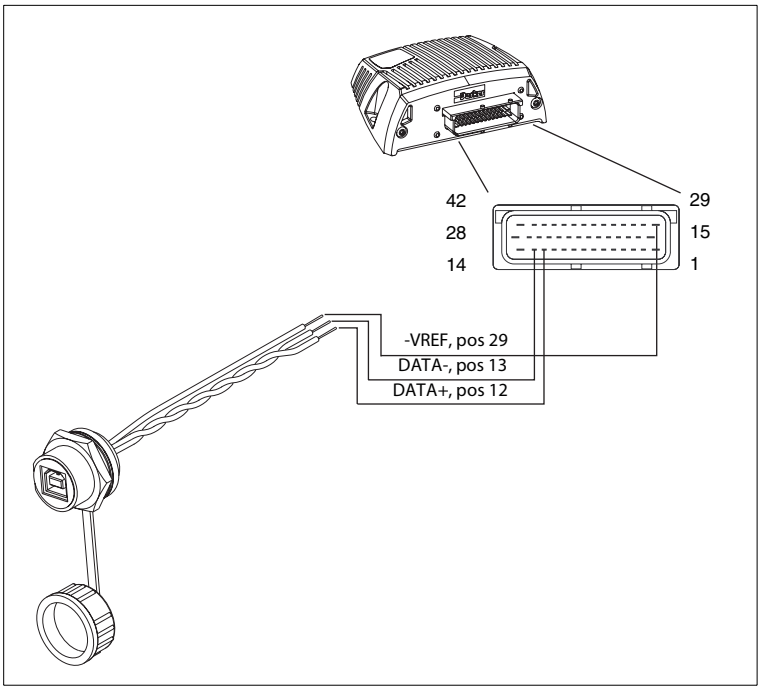
Skip application loading

If the ADDR_L voltage > 3.00V (ADDR_L pin shorted to ADDR_H) is detected when the unit starts (power up) the application will not be loaded. This is a special start-up mode that is used for master units and puts the MC2 in a safe state without starting any application. When this mode is desired, a jumper is put in place of an ID-Tag

USB connection

The MC2 has an *USB interface* for communicating with the programming software, IQANdesign and for diagnostics. A flying lead cable, 5030124 may be connected to the MC2 to provide an USB type B connector interface. The connection from the module to PC can be made with a standard USB Type A male to Type B male cable.

Connection of Parker cable 5030124 is shown below.



Connecting for USB communication.

NOTICE

It is recommended that the two data wires, *DATA+* and *DATA-*, be a twisted pair, 15 twists/meter. Use *-VREF* for the ground connection as shown.

USB and "ground loops" (differences in ground potential)

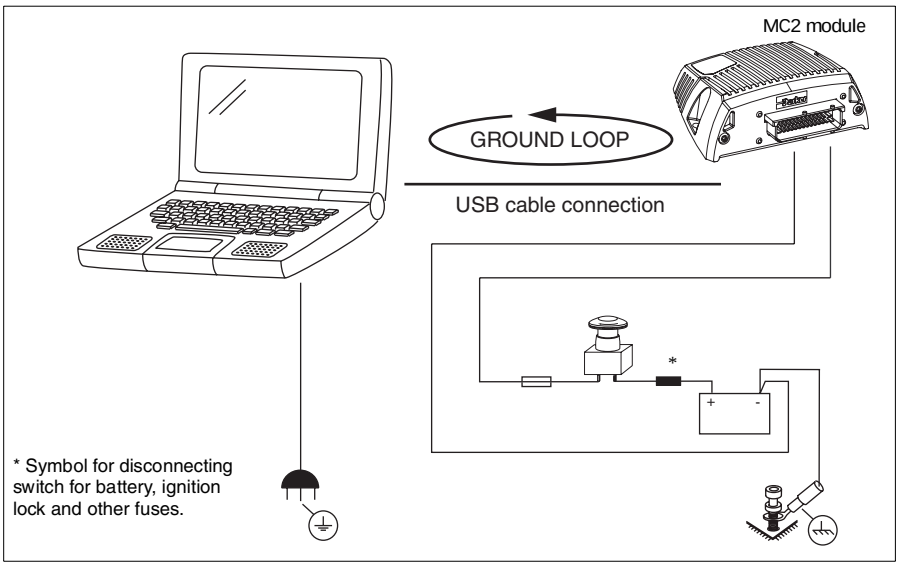
Ground loops occur when different parts of the machine or system have different electrical grounds. When systems consisting of machines, modules, computers and other devices with different ground potentials are connected by a USB cable, a ground loop may be created. The grounds may only differ by a few millivolts, or by much more. This can be significant when compared to the low level voltage signals that are used in USB data transmission. This condition can cause problems in communicating and in extreme cases the amount of current flow can damage the USB transceiver in the PC or the module.

The best way to prevent ground loops is to ensure that your system includes isolation. Isolation protects your PC from damage and preserves the integrity of your data by physically separating the electrical connections between the PC and the unit.

Isolation can be provided by adding an isolated USB hub between the PC and the unit.

Using a battery-powered laptop can prevent the formation of accidental ground loops and short circuits. This protection only holds true, however, as long as the laptop is not also connected to self-powered devices such as printers..

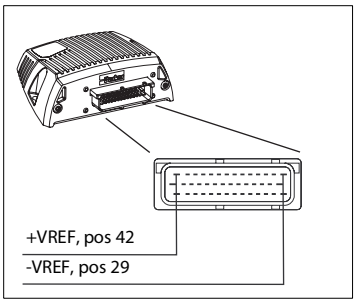
EXAMPLE



Possibility of ground loop when connecting PC to module via USB.

Reference voltage, VREF

The MC2 module is internally equipped with a voltage regulator to generate the reference voltage *VREF*. The standard reference voltage will feed different kinds of sensors and potentiometers.



VREF positions.

NOTICE

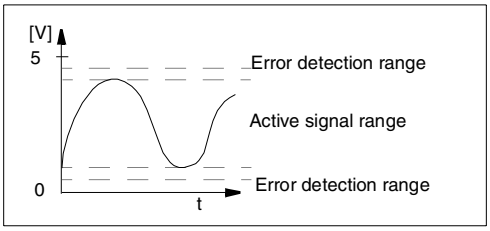
It is strongly recommended to use the module's *-VREF* and *+VREF* to all sensors and potentiometers that are connected to the module inputs. This will reduce bad measurement based on potential fault (i.e. different ground points for other supplies in relation to the MC2 ground -BAT).

Maximum load for the *VREF* is different according to 12/24 Vdc power supply, see Appendix A, on page 29.

Voltage inputs

Connecting sensors to the voltage inputs

The sensor signal range must be 0-5 Vdc. To detect signal errors such as short circuits or interruptions the active signal range be within 0.5-4.5 Vdc.



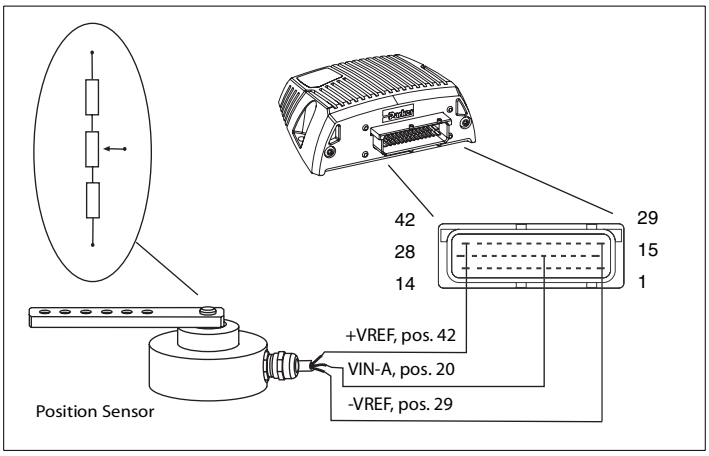
Active signal range.

The current consumption related to the voltage input is negligible.

The positive terminal of the sensor is connected to the +VREF position and the corresponding negative terminal to the -VREF position. The sensor signal is connected to appropriate VIN position.

EXAMPLE

Connect the positive and negative terminals of the position sensor to +VREF, position 42, and -VREF, position 29, respectively. Then connect the sensor signal to VIN-A, position 20.



Connecting VREF and sensor signal VIN-A.

NOTICE

The negative terminal of the sensor must not be connected to the chassis.

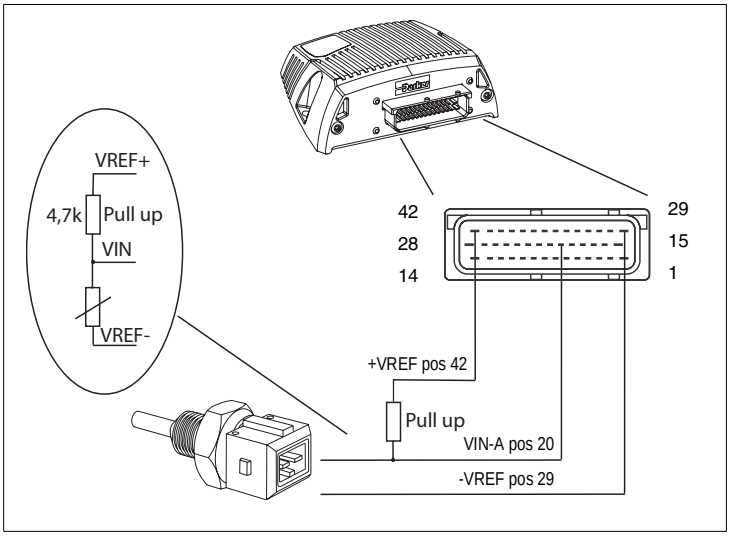
Maximum load for VREF position: see Appendix A, on page 29.

Connecting a 2-wire temperature sensor to voltage in

When you connect a passive temperature sensor you may need to use a pull up resistor on the input signal. Please check the technical data for your specific temperature sensor.

EXAMPLE

Connect the negative terminal of the PTC (positive temperature coefficient) temperature sensor to -VREF, position 29, and the signal to VIN-A, position 20. The pull up resistor will be connected between VIN-A, position 20 and +VREF, position 42.



Connecting -VREF and temperature sensor signal VIN-A.

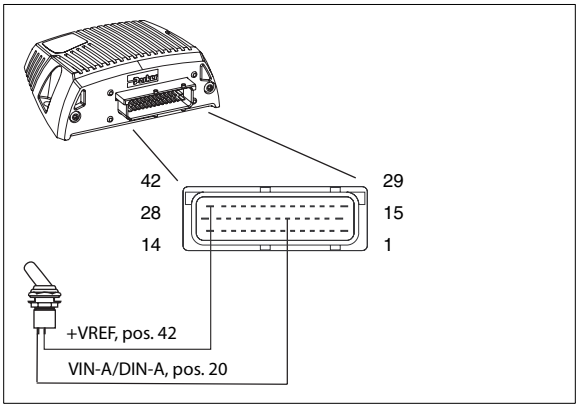
The pull up resistor value for a R=2000Ω PTC sensor is 4,7 KΩ

Connecting switches to the voltage inputs

Switches could be connected to the voltage inputs, to create a digital on/off signal. The switches should be connected to +VREF and VIN/DIN respectively for 5V signal. The current consumption for the input is negligible.

EXAMPLE

Connect the positive and negative terminals of the switch to +VREF, position 42, and VIN-A/DIN-A, position 20, respectively.



Connecting a switch to VIN-A/DIN-A and VREF.

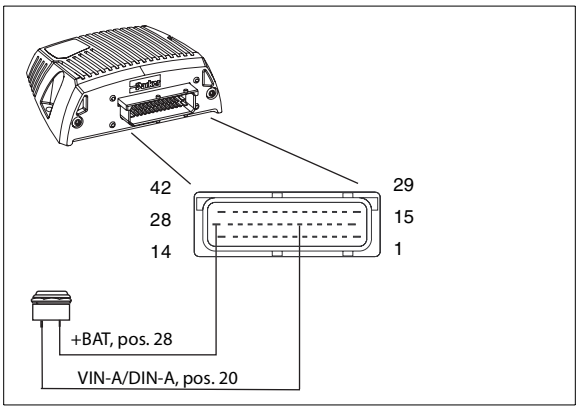
NOTICE

Maximum load for VREF position, see Appendix A, on page 29.

It is recommended to connect system voltage +BAT to the input through a switch in order to reserve 5Vdc VREF for sensors and potentiometers.

EXAMPLE

Connect the positive and negative terminals of the switch to supply or the unit's +BAT, position 28 and VIN-A/DIN-A, position 20, respectively.



Connecting a switch to VIN-A/DIN-A and +BAT.

DIN-A to DIN-E

These 5 digital inputs share pins with VIN-A to VIN-E and have high impedance characteristics. The above examples apply to these inputs.

DIN-F to DIN-M

These 8 digital inputs share pins with the RET pins of the proportional output channels E thru H. They have low impedance characteristics and an internal power clamping diode. If used they must be connected in a way that prevents "backending". See the following section for more information.

Connecting switches to the digital inputs

When connecting switches to the digital inputs DIN-F thru DIN-M, extra precautions should be taken.

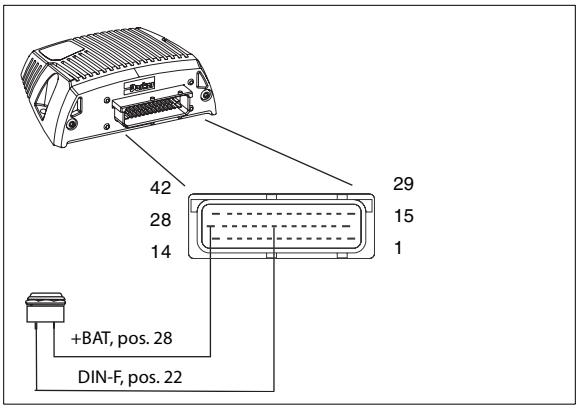
CAUTION

By sharing pins with the RET positions of the proportional outputs there is a possibility of 'backending' the IQAN-MC2 unit when using those pins as digital inputs. The internal circuitry has power clamping diodes between RET pins and +BAT. This arrangement creates a risk of inadvertently supplying power to the unit by forward biasing the clamping diodes. There are two methods to avoid this:

1 The switch could be powered by the same source as the unit's +BAT.
This needs to be after any switch that would shut off power to the MC2.

EXAMPLE

Connect the positive and negative terminals of the switch to +BAT, position 28 and DIN-F, position 22, respectively.

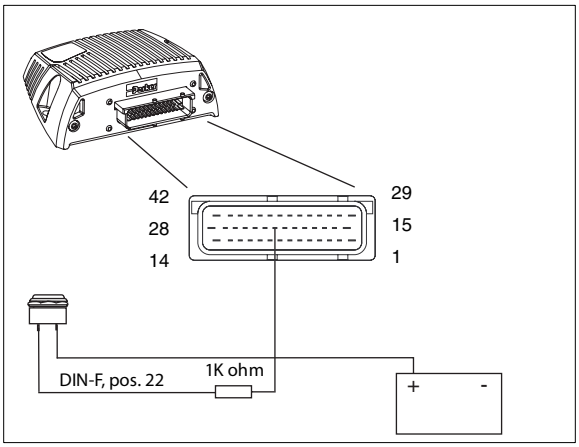


Connecting a switch to DIN-F and +BAT.

2 The switch could be connected to DIN through a 1K ohm resistor to limit the current source capability.

EXAMPLE

Connect the positive and negative terminals of the switch to supply and DIN-F through a 1K resistor, to position 22, respectively.



Connecting a switch to DIN-F and supply thru a resistor.

Remember that these flexible I/O pins must be configured in pairs of the same type, VIN, DIN or DOUT-LS.

Frequency inputs

Connecting sensors to the frequency inputs

Frequency inputs can operate in 2 modes. *Speed* which is frequency and *position* which is a pulse count. For the frequency ranges and trigger levels, see Appendix A, on page 29.

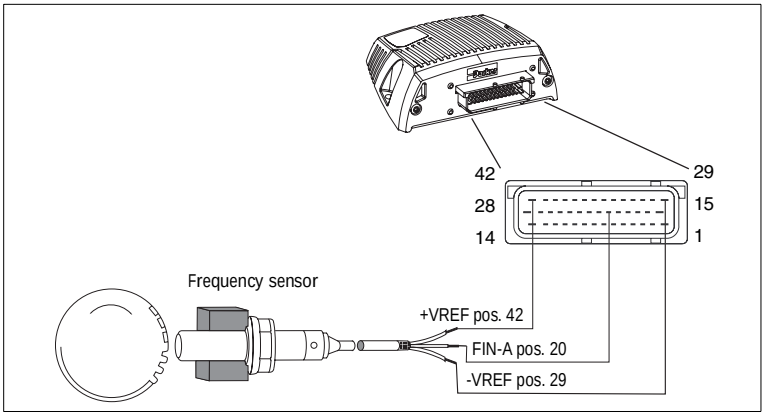
Simple frequency sensor

The positive terminal of the frequency sensor is connected to the +VREF and the negative terminal to the -VREF respectively. The sensor signal is
connected to the FIN position.

If the current consumption for the sensor exeeds the maximum load for the VREF, the sensor could be connected to the +BAT/-BAT positions.

EXAMPLE

Connect the positive and negative terminals of the frequency sensor to +VREF, position 42, and -VREF, position 29, respectively. Then connect the sensor signal to FIN-A, position 20.



Connecting of frequency sensor.

NOTICE

The negative terminal of the sensor must not be connected to the chassis.
Maximum load for VREF position, see Appendix A, on page 29.

Proportional outputs

The current /PWM outputs control proportional valves and devices. For the current range and loads, see Appendix A, on page 29.

Frequency

To obtain the best performance from proportional valves the control produces a current mode (closed loop) output signal or a PWM voltage (open loop) output signal. The type of output is selectable in IQAN software. The units have an adjustable frequency which can be changed using IQAN software.

The table below shows the MC2 frequency possibilities. Any frequency may be entered in your application and is translated according to this table. The bold values are the actual frequencies in Hz output by the MC2 for proportional valve control..

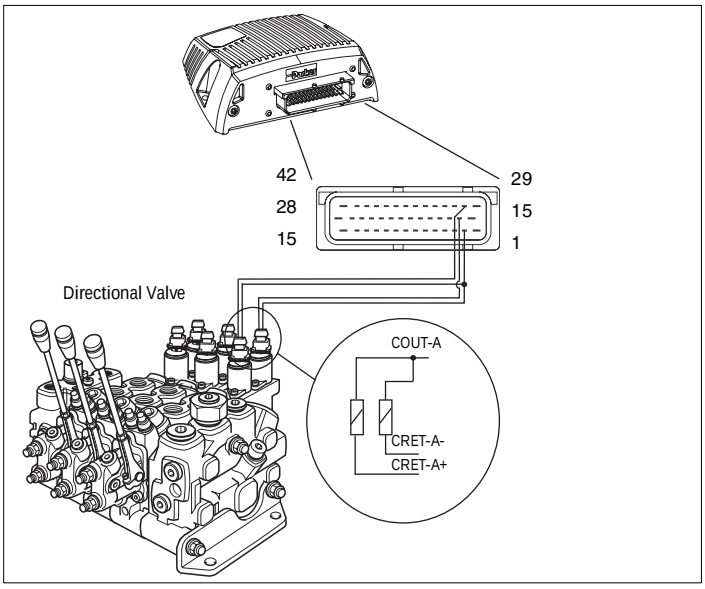
Frequency (Hz) entered in appl.	Frequency (Hz) output by MC2	Frequency (Hz) entered in appl.	Frequency (Hz) output by MC2
25	**25**	50-52	**50**
26	**26**	53-55	**53**
27	**27**	56-58	**56**
28	**28**	59-62	**59**
29	**29**	63-66	**63**
30	**30**	67-70	**67**
31	**31**	71-76	**71**
32	**32**	77-82	**77**
33	**33**	83-90	**83**
34-35	**34**	91-99	**91**
36	**36**	100-110	**100**
37	**37**	111-124	**111**
38-39	**38**	125-142	**125**
40-41	**40**	143-166	**143**
42	**42**	167-199	**167**
43-44	**43**	200-249	**200**
45-47	**45**	250-332	**250**
48-49	**48**	333+	**333**

Connecting loads to proportional outputs

Connecting a load, e.g. one proportional valve section, to the current mode or PWM mode outputs is done by using the COUT/CRET paired positions.

EXAMPLE

Positive direction:
Connect the proportional valve to the COUT-A, position 2 and the CRET-A+, position 16 respectively.
Negative direction:
Connect the proportional valve to the COUT-A, position 2 and the CRET-A- , position 30 respectively.



Connecting a load to a proportional output.

NOTICE

DO NOT install diodes across coils for Current or PWM modes!

Digital outputs

The digital outputs control relays and on/off valves.
For the maximum load per output see Appendix A, on page 29.

Connecting loads to digital outputs

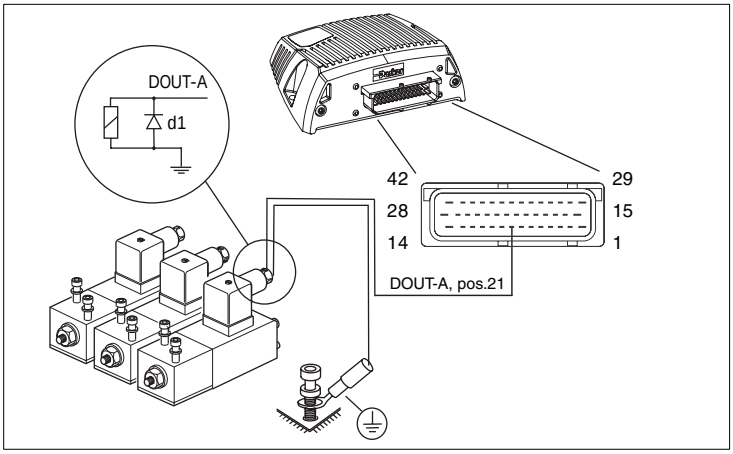
Connecting of loads to the digital outputs such as on/off valves is done by using the DOUT-A thru DOUT-F positions and the negative battery terminal as ground.

Protection against voltage transients

A clamping diode must be placed between the digital output and ground, as close to the load as possible. This protects the output against high voltage transients.
Use the diode: 1N5408 (3A/1000V).
Depending on the load, other clamping diodes might be used instead.

EXAMPLE

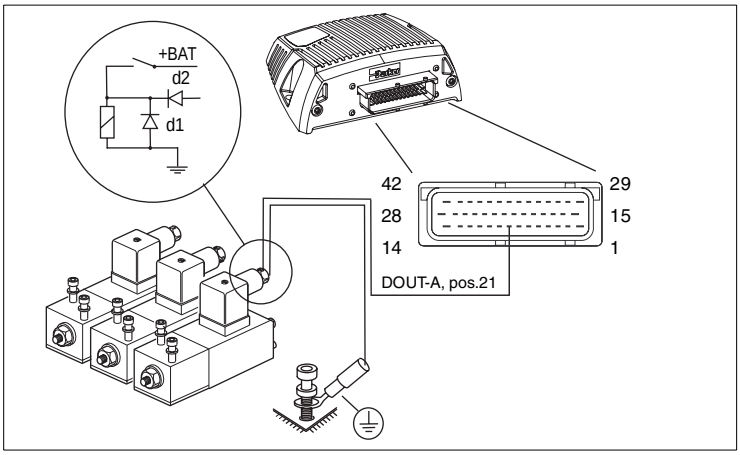
Connect the on/off valve to the digital output using the DOUT-A, position 8, and the negative battery terminal as ground.
A clamping diode must be placed as close to the load as possible, see figure below.



Connecting a load to the digital output.

NOTICE

If the load is controlled in parallel with another system, the digital output must be protected with a diode.



Digital output protected with a diode.

Low-side digital outputs

The low-side digital outputs may control relays and on/off valves.
For the maximum load per output see Appendix A, on page 29.

Connecting loads to low-side digital outputs

Connecting of loads to the low-side digital outputs such as on/off valves is done by using the DOUT(LS)-I thru DOUT(LS)-X positions and one or more DOUT channels as supply.

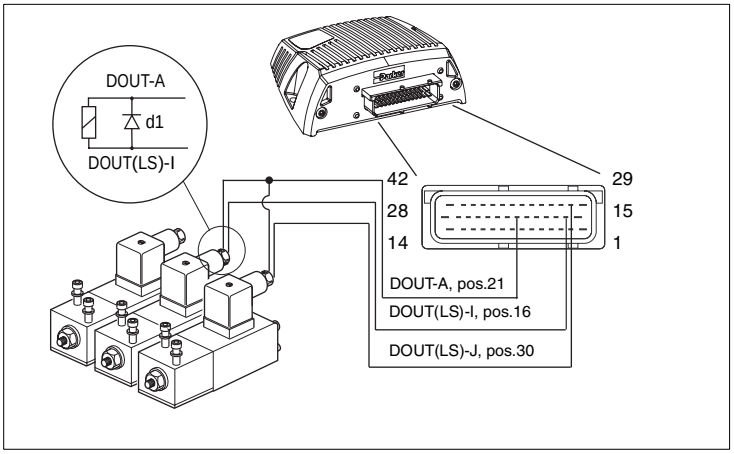
Protection against voltage transients

A clamping diode must be placed between the source and low-side digital output, as close to the load as possible. This protects the output against high voltage transients.
Use the diode: 1N5408 (3A/1000V).

Depending on the load, other clamping diodes might be used instead.

EXAMPLE

Connect the on/off valves to the low-side digital outputs using the DOUT(LS)-I, position 16, DOUT(LS)-J, position 30 and the DOUT-A, position 2 as supply.
A clamping diode must be placed as close to the load as possible, see figure below.



Connecting loads to the low-side digital outputs.

CAUTION

Loads on DOUT with Low-Side switch (DOUT[LS]-I to DOUT[LS]-X) must be controlled on the high-side by connection to a DOUT with High-Side switch (DOUT-A to DOUT-H) for safe function. The total sum of current supplied to the loads controlled by a number of DOUT[LS] is limited to 2000mA.

Remember that these flexible I/O pins must be configured in pairs of the same type, VIN, DIN or DOUT-LS.

7 Start-up

Start-up procedures

This chapter contains instructions for action to be taken in connection with the initial start, for example, setting values, calibrating and testing the system.

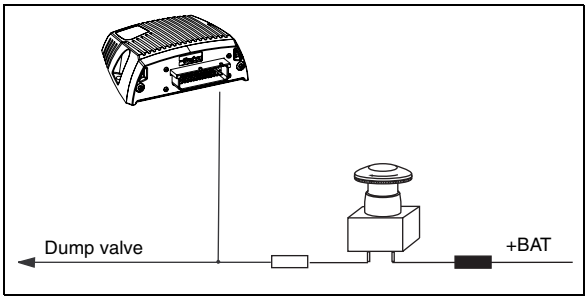
WARNING
Risk of injury!
If the control system is not fitted properly, the machine could move uncontrollably. The machine's engine shall not be started before the control system is completely fitted and its signals are verified.

Starting the control system

Start the control system as follows:

- Prior to start, all modules and cables are to be fitted correctly.
- Check fuses, i.e. make sure that the supply voltage to the modules is equipped with the correct fuse.
- Make sure that connections for supply voltage and return lines are correct in the cable's conductor joint.
- Make sure that the ID-tag is connected properly if used.
- Make sure the emergency stop works.

The emergency stop should disconnect the supply voltage to all modules.



Emergency stop.

Alternatively, the emergency stop may also shut off the diesel engine or a dump valve, and with that depressurize the hydraulic system.

Prepare for system start

WARNING
Make sure no one is in dangerous proximity to the vehicle to avoid injuries when it starts.

Prepare for the initial system start as follows:

- The engine for the hydraulic system's pump shall be in off position.
- Make sure that all connectors are properly connected.
- Turn on the control system.
- Make sure that voltage is being supplied to all modules, the green diode shall be illuminated on all modules. Also make sure that master is in contact with all modules by checking the master's status LED. Error codes are blinked if the master is not in contact with one or more of the modules.
- Make sure the emergency stop is functioning properly.

Start the system

Start the system as follows:

- Start the engine for the hydraulic system's pump, assuming that the above mentioned inspections have been carried out and shown correct values.
- Calibrate and adjust input and output signals according to the instructions related to the master menu system and check each and every output function carefully.
- In addition to these measures, the machine shall also meet the machine directives for the country in question.

Appendix A

IQAN-MC2 Technical Overview

Absolute Maximum Ratings[a]

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Ambient temperature, T_A Storage temperature	– 40 – 40		+85 +100	°C	
Voltage supply on +BAT	6		34	V	Reverse polarity protected with 20A fuse.
Voltage on any pin with respect to -BAT			34	V	Max voltage on USB signals D+ / D- is 3.5V
Maximum current into -VREF			2	A	
Maximum current sourced or sinked by all outputs			20	A	

a.The “Absolute Maximum Ratings” table lists the maximum limits to which the device can be subjected without damage. This doesn´t imply that the device will function at these extreme conditions, only that, when these conditions are removed and the device operated within the “Recommended Operating Conditions”, it will still be functional and its useful life wonít have been shortened.

Environmental ratings

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
EMI					
ISO 14982:1998				MHz	30-3000 MHz
EN 55025:2003				MHz	0.15-108 MHz
ISO 11452-2:1995			100	V/m	20-1000 MHz
ISO 11452-4:2001			150	mA	1-200 MHz
ISO 7637-3:1995			80	V	
ISO 7637-2:1990				V	1a,2,3a,3b,4,5
ESD					
ISO 10605:2001			15 8 8	kV	air contact handling
Mechanical environment					
IEC 68-2-64:1993 Fh			0.4	g^2/Hz	15- 250 Hz, 10 hours
IEC 68-2-29:1987 Eb			40	g	6 ms
Climate environment					
IEC 600529:2001 IP66			3	min	30 kPa, 12.5 l/min
DIN 40050 Part 9:1993 IP6K9K			30	sec	1000kPa, +80°C
IEC 60068-2-30:1985 Db			6	cycles	+55°C, 95% RH
IEC 60068-2-78:2001			21	days	44°C, 93% RH
IEC 60068-2-2:1993-01 Bb			72	hour	70°C
IEC 60068-2-1:1993-02 Ab			16	hour	-40°C
IEC 60068-2-14:1984 Nb			10 x 6	hour	-40°C to 70°C
Chemical environment					
IEC 68-2-52:1996 Kb			3	days	

Recommended Operating Conditions[a]

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Ambient temperature, T_A	– 30		+70	°C	
Voltage supply, V_{BAT}	11		32	V	
Total load on COUT/PWMOUT/DOUT			16	A	

a.Recommended operating conditions are given for maximum and minimum conditions where normal performance is still available from the device. Once the normal operating conditions are exceeded, the performance of the device may suffer.

System

T_A = +25 °C (unless otherwise specified)

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Start-up delay		250		ms	Power to activated output
Dither frequency, *DF*	25		333	Hz	
System cycle time	5		100	ms	
Sample rate local I/O	5		100	ms	System cycle time
Output voltage on VREF	4.95	5.00	5.05	V	load < 50mA
Maximum load current on VREF V_{BAT} =11V to 32V			150	mA	
Current supply V_{BAT} =14V V_{BAT} =28V			200 160	mA	outputs = off no load on VREF
Current supply RTC +*RTC* =14V +*RTC* =28V			4 8	mA	Same supply current for V_{BAT}=0V or V_{BAT} > 11V

I/O

T_A = +25 °C (unless otherwise specified)

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
VIN (Voltage input)					
Signal range low		0	0.05	V	
Signal range high	4.95	5.00		V	
Input resistance		36		kΩ	
Signal resolution		1.2		mV	5000/4095 = 1.2
Relative accuracy[a]			10	mV	
DIN (On/off input)					
Input signal low			1.0	V	
Input signal high	4.0			V	
Input hysteresis		1.0		V	
Input resistance		36		kΩ	
FIN (Frequency input)					
Input signal low			1.0	V	
Input signal high	4.0			V	
Input hysteresis		0.3		V	

I/O

T_A = +25 °C (unless otherwise specified)

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Input resistance		36		kΩ	
Input frequency low	2 1/T_{sc} 0			Hz	Speed mode - normal Speed mode - fast Position mode
Input frequency high			20.000	Hz	
Step response time (Speed mode)	T_{sc}				
Step response time (Position mode)	T_{sc}				
Zero detection time (Speed mode, start or stop <20 Hz)	1.1 T_{sc}			s	Speed mode - normal Speed mode - fast
COUT (closed-loop mode)					
Signal range (I_L)	100		2000	mA	
Load	3.5			Ω	
Error limit min.(open load)		50		us	
Error limit max. (overload)		T-500		us	T = 1/f_{dither}
Voltage drop (V_{BAT} -V_{DOUT}) I_L = 500mA I_L = 2000mA		 0.4 2.0		V	
Off-State output current:			1	mA	
Short Circuit current limit		2.5		A	
Relative accuracy[b]			15	mA	PVC25-12V PVC25-24V DF161-12V DF161-24V pump/motor
Temperature error			15	mA	T_A= -40°C to 70°C (nominal @ 25°C) I_L = 500mA
Power supply rejection V_{BAT}= 11... 18V V_{BAT}= 24... 32V		 2 2		mA	PVC25-12/24V DF161-12/24V
Load regulation V_{BAT}=14V, R_L=4... 9 Ω V_{BAT}=28V, R_L=22... 34 Ω		 2 2		mA	Load= PVC25-12V, DF161-12V PVC25-24V, DF161-24V
Dither frequency, *DF*	25		333	Hz	
Resolution		0.1 1.0		mA us	Dependent on load, power supply and dither frequency.
PWMOUT (open-loop mode)					
Signal range	0		95	% MR	
Load current			2	A	
Pulse width low	T/1000			s	T = 1/f_{dither}
Pulse width high			T	s	
Error limits min (open load)		-		mA	No open load detection

I/O

T_A = +25 °C (unless otherwise specified)

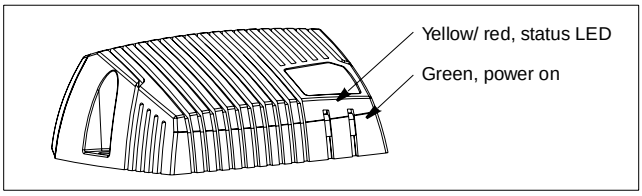
Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Error limits max (over load)		2.5		A	
Voltage drop (V_{BAT} V_{PWMOUT}) load I_L = 0.5A load I_L = 2A		 0.4 2.0		V	
Off-State output current:			1	mA	
Short Circuit current limit		2.5		A	
Dither frequency, *DF*	25		333	Hz	
Resolution		0.1		% MR	
DOUT (on/off output)					
Load current			2	A	
Voltage drop (V_{BAT} -V_{DOUT}) load I_L = 0.5A load I_L = 2A		 0.2 1.0		V	
Off-State output current:			1 0.1 2.5	mA	DOUT-A to H DOUT[LS]-I to P DOUT[LS]-Q to X
Max load inductance:			200 1000	mH	@ 2A @ 1A
Short Circuit current limit		2.5 5.0		A	DOUT-A to H DOUT[LS]-I to X

a.Deviation of the output current at any command from its theoretical value (command value).
b.Deviation of the output current at any command from its theoretical value (command value).

Appendix B

Error codes, messages and actions

If one of the following error is detected, a message will be presented on the display together with an error code on the module. In some cases, the module will turn off or at least shut down the outputs, to increase safety.



The location of the LED indicators on the IQAN-MC2 module.

WARNING

Don't use the machine if an error message or error code is activated.

The following sections will present what measures to take for different error situations put into appropriate context.

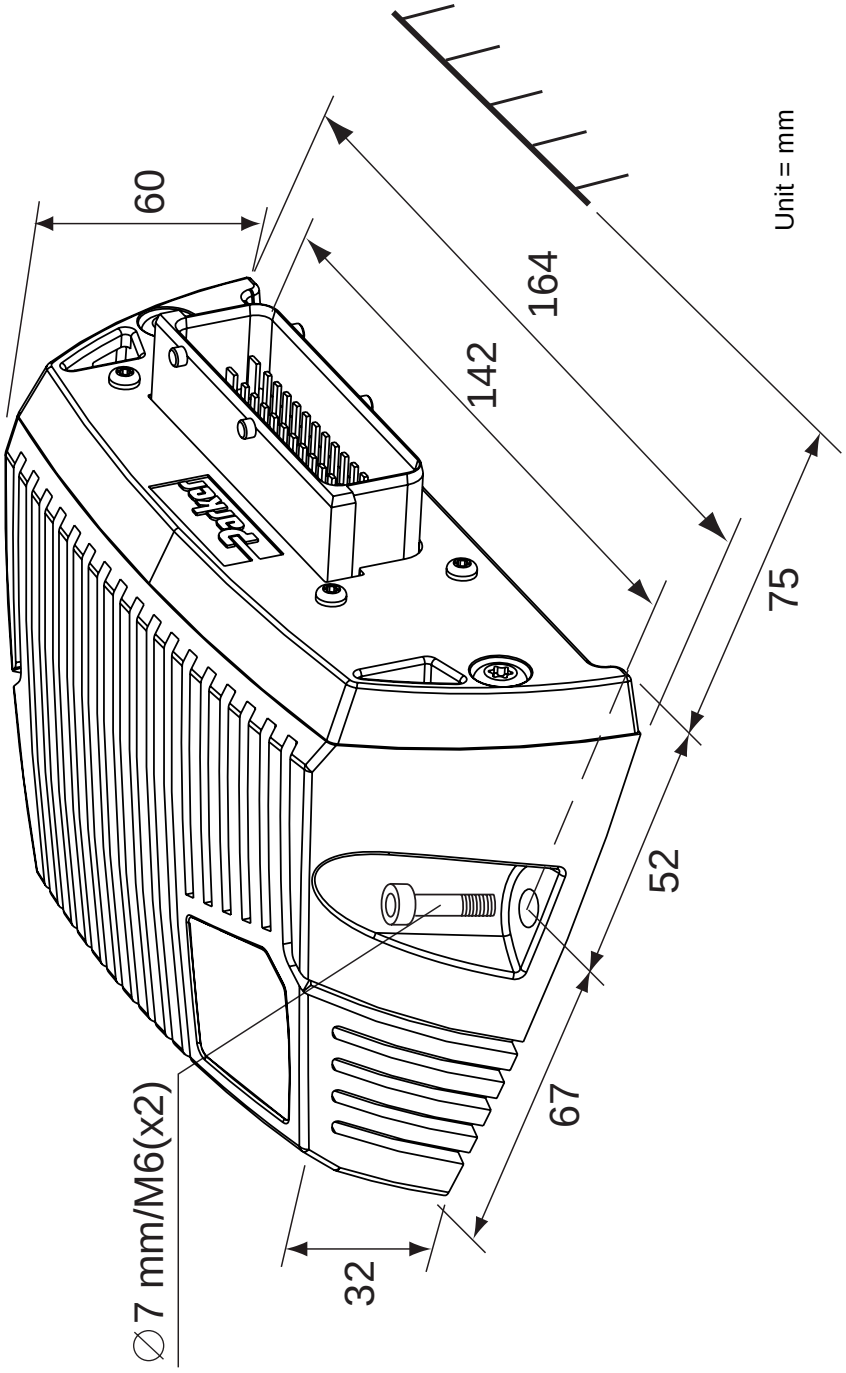
LED indicator showing different MC2 modes

Status	Flash (yellow)
Normal operation	
Application not loaded	
No application available	
Bad application	
Busy	

Error code	Error	Primary Flash (red) Error category	Secondary Flash (yellow) Error description
1:1	Output		
1:2	Input		
1:3	Vref		
2:1	Power Supply		
2:2	Temperature		
2:3	Clock		
3:1	CAN error		
3:2	Address error		
4:1	Internal error		
SCS	Safe Crash State		

Appendix C

Dimensioning of the IQAN-MC2 module



For the latest information visit our website www.iqan.com

Information in this instructionbook is subject to change without notice

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