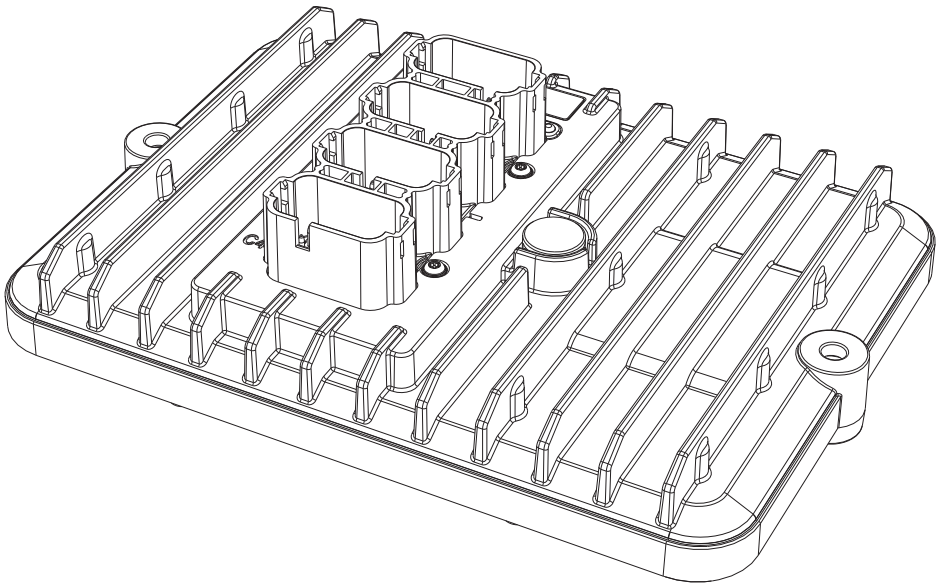
IQAN-MC31
Instruction book

Publ no HY33-8411-IB/UK
Edition 2017-01-25



ENGINEERING YOUR SUCCESS.

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.

Warnings

Sections 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 symbols used in this manual are defined below.

WARNING
Sections labeled *WARNING* with a caution symbol in the left margin, indicate that a hazardous situation exists. We use warnings, marked with the warning symbol, in two ways.

- As a strong recommendation about work practices when using the product in the machine (e.g. routines when updating an application). This use is common to the term 'hazardous situation', that a person is exposed to a hazard.
- As a way of pointing out important information for the machine designer that in some way relates to safety. This includes the design of the physical machine, and also the application program being developed for the control system.

Not all document sections that contain information about safety are marked with a warning symbol (there would be warnings everywhere). Failure to comply with the recommendations can cause unintentional, and unexpected behavior of the control system. This can potentially cause death, serious injury or property damage.

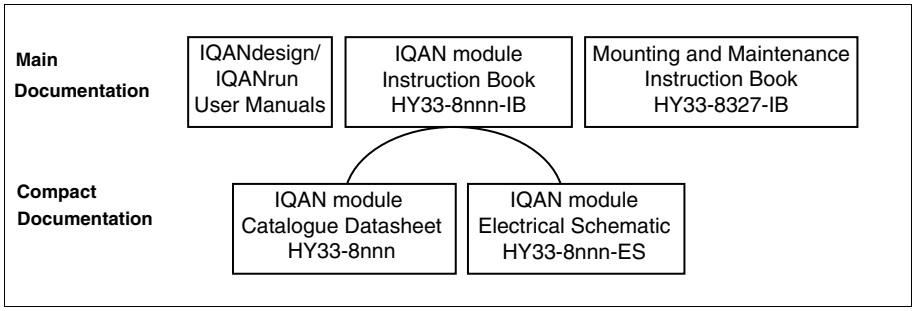
NOTICE
Sections labeled *NOTICE* with a notice symbol in the left margin, indicate there is important information about the product. Ignoring this could result in less than optimal performance, or damage to the product.
Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.
The term "manufacturer" refers to Parker Hannifin Corporation.

Overview of relevant documentation

The following publications are relevant for users of this product.

The main documentation contains information that is not found elsewhere.

The additional documentation contains product information in a compact format, for details on the information found in those documents, consult this manual.



The IQAN module documentation system.

2 Precautions

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
Make sure that you have sufficient knowledge before designing, modifiying or servicing the control system.
Read the relevant sections of this document before conducting any work on the control system.

WARNING
This product is not field repairable.

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.

Read This

Design of control system

WARNING
Risk of injury may be introduced by design of control system!
This product is designed to control hydraulic outputs. The control application must be designed using basic safety principles so that unintentional movement is avoided.
The machine must be equipped with an emergency stop that stops all movement. Please refer to section "Supply voltage".

Before you start

Read this document.
Read the IQANdesign software user manual section on 'application safety'.

Start-up, maintenance, and diagnostics

For all personnel carrying out installation, commissioning, maintenance or troubleshooting.

WARNING
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.

Before you start,
Read section "Start-up".

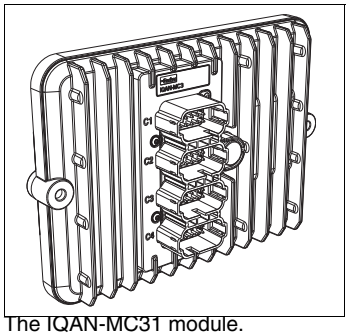
Additional information for service
Mounting and maintenance instruction book.

Additional information for diagnosing the system
Read section "System diagnostics", and see "Appendix B", in this document.
Use the IQANrun software user manual as a reference.

3 Product description

IQAN-MC31

The IQAN-MC31 is designed for controlling hydraulic systems in vehicles and machinery, using 12/24 Vdc power supply.
IQAN-MC31 is a master unit capable of running applications created by IQANdesign. The MC31 has local I/O for input/output use and has four CAN busses that support ICP (IQAN CAN Protocol), SAE J1939 and Generic CAN.
By supporting SAE J1939 and Generic CAN the MC31 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.

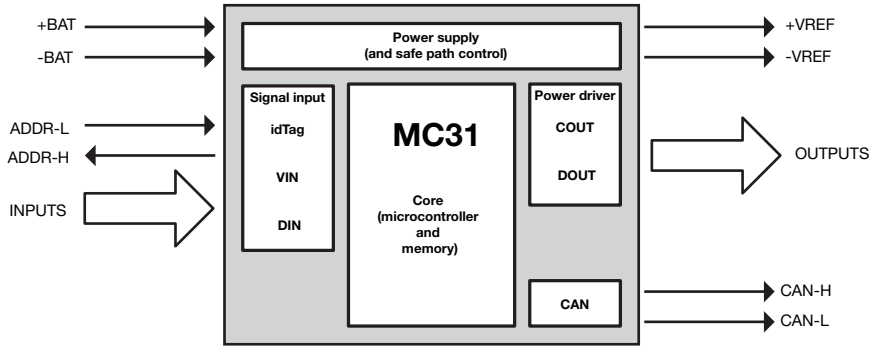


The IQAN-MC31 module.

IQAN-MC31 origins

The IQAN-MC31 is based on the IQAN-MC3 hardware but it has the safety functions removed in the operating software. This is done to enable bigger applications and a faster cycle time.

I/O overview



Voltage Inputs

The IQAN-MC31 module has sixteen (16) *voltage inputs* VIN-A thru VIN-P for connection of 0-5 Vdc signals.

(16) Voltage inputs VIN-A thru VIN-P

Digital Inputs

The IQAN-MC31 module also has sixteen (16) *on/off inputs* DIN-A thru DIN-P for switches. The inputs are multi-purpose and for flexibility may be configured in other ways. The input pins DIN-A thru DIN-H can be configured as *frequency inputs* for measuring frequency. *On/off inputs* and *frequency inputs* share positions, see list.

(16) Digital inputs DIN-A thru DIN-P

or

(8) Frequency inputs FIN-A thru FIN-H use positions DIN-A thru DIN-H.

and

(8) Digital inputs DIN-I thru DIN-P.

Proportional outputs

The MC31 module has four (4) double *proportional outputs* for controlling proportional valves. These outputs can control four bi-directional valve sections or four 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. See below.

(4) double proportional outputs COUT-A thru COUT-D

or

(4) double proportional outputs PWMOUT-A thru PWMOUT-D

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

Digital outputs

The MC31 module has ten (10) digital outputs for driving on-off solenoids. There are five (5) high side outputs and five (5) low side outputs. See below.

(5) High side digital outputs DOUT-F thru DOUT-J

and

(5) Low side digital outputs DOUT-K thru DOUT-O

These outputs can be combined to provide five (5) diagnostic capable configurations. See below.

(5) Diagnostic digital outputs DOUT-A (HS + LS) thru DOUT-E (HS + LS)

CAN related functions

The IQAN-MC31 uses a CAN-bus (CAN = Controller Area Network) to communicate with IQAN expansion modules and other systems. The CAN-bus is a robust communication protocol that is widely used and well proven within the automotive industry.

The unit has four (4) CAN buses, CAN-A thru CAN-D. The buses may be configured using IQAN software to be ICP (ICP = IQAN CAN Protocol), SAE J1939 or Generic user defined CAN protocol (e.g. CANopen).

Communication

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

CAN

The IQAN-MC31 has 4 CAN buses. Either of the CAN buses may be used for communication and diagnostics. A CAN communication card is required to be installed in your PC to use this feature.

Markings/Approvals

Declaration of Conformity

We: Parker Hannifin Manufacturing Sweden AB
Electronic Controls Division

Located at: Mölnlycke Fabriker 14
S-435 35 Mölnlycke, SWEDEN

Declare that the products identified herein comply with the essential requirements of the following EU directives:

2004/108/EC	**EU EMC Directive**
2011/65/EU	**EU RoHS II Directive**

Harmonized standards:

ISO 14982:2009	Agricultural and forestry machines - Electromagnetic compatibility - Test methods and acceptance criteria
EN 13309:2010	Construction machinery - Electromagnetic compatibility of machines with internal electrical power supply
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Trade Name: Electrohydraulic Control Systems
Products: **IQAN-MC31**

Signature of responsible party:

Printed name of responsible party: Håkan Jisland
Position of responsible party: Operations Manager

Executed on December 15, 2014, at Mölnlycke, Sweden

4 Safety

Internal diagnostics

The module performs a number of self-checks that improve safety. Checks include monitoring of voltage supplies, checksums on memory and a watchdog that monitors software execution. The module is using a real time operating system which supervises software execution.

If a critical error is detected, the module is stopped, with CAN-bus and outputs off.

CAN-bus interruption

The IQAN modules communicate on a CAN-bus. Both the master module and expansion modules check for any interruptions in CAN-bus communication. If an error occurs the master will use zero or an application defined error value for the module inputs, and the module outputs will be off.

The error will be presented on the master/display module, if there is one, and with a related blink code on the IQAN module status LEDs, see Appendix B.

Current check

For modules with proportional outputs, when used in current mode a current check is performed. If an error is detected, this will be indicated on the master module, and the output will shut off.

The module can detect open-circuit, short-circuit to +BAT/-BAT or short-circuit to other proportional output and return pins.

Emergency stop

WARNING

Risk of injury!

The emergency stop must disconnect the power supply to the module; do not connect the emergency stop as a signal input only.

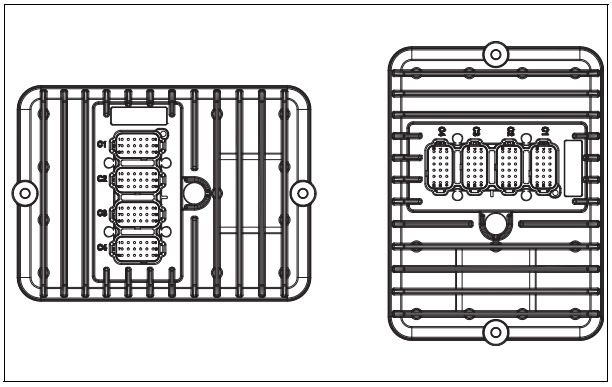
The emergency stop must be installed so that the risk of reverse feed of the module is avoided, see section "Supply voltage".

5 Mounting

Mounting the module

The IQAN-MC31 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 circulate 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.
- For maximum cooling, mount the module on a vertical surface.
- Locate the module so that the LEDs are visible.



Recommended placing.

NOTICE

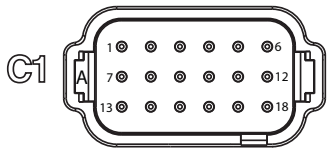
The IQAN-MC31 module must not be placed in any marine related or similar continuously damp, salt-spray environment without external protection.

6 Installation

Connectors C1-C4

Connector C1 pin assignments

Connector kit	**Parker no. 5035016[a]**
Housing	Deutsch no. DT16-18SAK004
Pin types	1062-16-0644
Cables	0.75 mm² (18 AWG)
Plugs (empty pos.)	Deutsch no. 114017
Deutsch crimping tool reference	DTT-20-00
Prototype cable	**Parker no. 5030216**

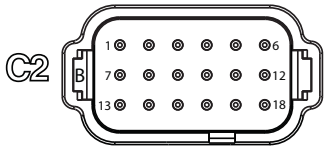


a.Kit contains parts for all 4 connectors, C1 - C4

Symbol	Pin No.	In Out	Function
-BAT	1	-	Power supply GND
-BAT	2	-	Power supply GND
CAN-A-L	3	-	CAN low voltage bus line, will be LOW in dominant state.
CAN-A-H	4	-	CAN high voltage bus line, will be HIGH in dominant state.
CAN-B-L	5	-	CAN low voltage bus line, will be LOW in dominant state.
CAN-B-H	6	-	CAN high voltage bus line, will be HIGH in dominant state.
ADDR-L	7	-	IdTag interface. Low side to address tag. Return signal.
ADDR-H	8	-	IdTag interface. High side to address tag. Sourcing +5V.
CAN-C-L	9	-	CAN low voltage bus line, will be LOW in dominant state.
CAN-C-H	10	-	CAN high voltage bus line, will be HIGH in dominant state.
CAN-D-L	11	-	CAN low voltage bus line, will be LOW in dominant state.
CAN-D-H	12	-	CAN high voltage bus line, will be HIGH in dominant state.
+BAT	13	-	Power supply 12/24 Vdc
+BAT	14	-	Power supply 12/24 Vdc
DOUT-I	15	O	DOUT power driver, high side
DOUT-N	16	O	DOUT power driver, low side
DOUT-J	17	O	DOUT power driver, high side
DOUT-O	18	O	DOUT power driver, low side

Connector C2 pin assignments

Connector kit	**Parker no. 5035016[a]**
Housing	Deutsch no. DT16-18SBK004
Pin types	1062-16-0644
Cables	0.75 mm² (18 AWG)
Plugs (empty pos.)	Deutsch no. 114017
Deutsch crimping tool reference	DT-20-00
Prototype cable	**Parker no. 5030217**

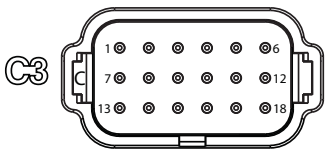


a.Kit contains parts for all 4 connectors, C1 - C4

Symbol	Pin No.	In Out	Function
-VREF-A	1	-	Voltage reference for external sensors. Return (0V)
+VREF-A	2	-	Voltage reference for external sensors. Sourcing +5V
VIN-A	3	I	Voltage signal input
VIN-B	4	I	Voltage signal input
VIN-C	5	I	Voltage signal input
VIN-D	6	I	Voltage signal input
VIN-E	7	I	Voltage signal input
VIN-F	8	I	Voltage signal input
VIN-G	9	I	Voltage signal input
VIN-H	10	I	Voltage signal input
VIN-I	11	I	Voltage signal input
VIN-J	12	I	Voltage signal input
VIN-K	13	I	Voltage signal input
VIN-L	14	I	Voltage signal input
VIN-M	15	I	Voltage signal input
VIN-N	16	I	Voltage signal input
VIN-O	17	I	Voltage signal input
VIN-P	18	I	Voltage signal input

Connector C3 pin assignments

Connector kit	**Parker no. 5035016[a]**
Housing	Deutsch no. DT16-18SCK004
Pin types	1062-16-0644
Cables	0.75 mm² (18 AWG)
Plugs (empty pos.)	Deutsch no. 114017
Deutsch crimping tool reference	DT-20-00
Prototype cable	**Parker no. 5030218**

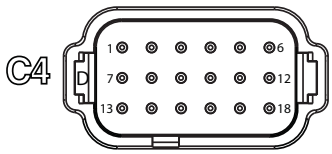


a.Kit contains parts for all 4 connectors, C1 - C4

Symbol	Pin No.	In Out	Function
-VREF-B	1	-	Voltage reference for external sensors. Return (0V)
+VREF-B	2	-	Voltage reference for external sensors. Sourcing +5V
DIN-A	3	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-B	4	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-C	5	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-D	6	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-E	7	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-F	8	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-G	9	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-H	10	I	DIN / FIN / DFIN / PCN /DPCN signal input
DIN-I	11	I	Digital signal input
DIN-J	12	I	Digital signal input
DIN-K	13	I	Digital signal input
DIN-L	14	I	Digital signal input
DIN-M	15	I	Digital signal input
DIN-N	16	I	Digital signal input
DIN-O	17	I	Digital signal input
DIN-P	18	I	Digital signal input

Connector C4 pin assignments

Connector kit	**Parker no. 5035016**[a]
Housing	Deutsch no. DT16-18SDK004
Pin types	1062-16-0644
Cables	0.75 mm² (18 AWG)
Plugs (empty pos.)	Deutsch no. 114017
Deutsch crimping tool reference	DT-20-00
Prototype cable	**Parker no. 5030219**



a.Kit contains parts for all 4 connectors, C1 - C4

Symbol	Pin No.	In Out	Function
COUT-A	1	O	COUT power driver, high side
CRET-A+	2	O	COUT power driver, low side
CRET-A-	3	O	COUT power driver, low side
COUT-B	4	O	COUT power driver, high side
CRET-B+	5	O	COUT power driver, low side
CRET-B-	6	O	COUT power driver, low side
COUT-C	7	O	COUT power driver, high side
CRET-C+	8	O	COUT power driver, low side
CRET-C-	9	O	COUT power driver, low side
COUT-D	10	O	COUT power driver, high side
CRET-D+	11	O	COUT power driver, low side
CRET-D-	12	O	COUT power driver, low side
DOUT-F	13	O	DOUT power driver, high side
DOUT-K	14	O	DOUT power driver, low side
DOUT-G	15	O	DOUT power driver, high side
DOUT-L	16	O	DOUT power driver, low side
DOUT-H	17	O	DOUT power driver, high side
DOUT-M	18	O	DOUT power driver, low side

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. The figure below shows how to connect the emergency stop.

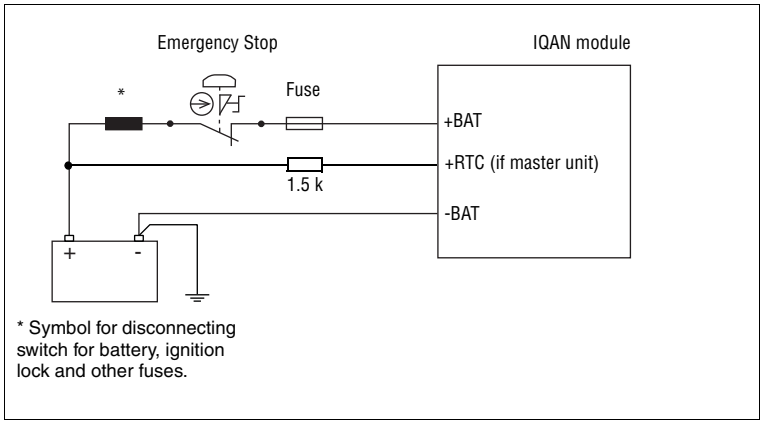
Connecting of Supply Voltage

The supply voltage, should be within the operating interval, see Appendix A. Connect the supply voltage to +BAT and -BAT. Protect the module by using a fuse. For recommended fuse level, see Appendix A.

RTC supply

IQAN master modules have a clock that is used for date/time stamping when logging data. The *real time clock*, +RTC, requires a separate positive power connection. Connect the supply voltage to +RTC through a 1.5K ohm resistor. The resistor should be as close to the battery as possible for safety.
IQAN expansion modules do not have +RTC.

WARNING
Risk of injury!
To reduce the risk for uncontrolled supply of an IQAN master module, i.e., a short circuit between the +RTC cable and +BAT, a resistor must be connected between the battery and the +RTC input. This is important as this line is not controlled by an emergency stop.
The resistor should be placed close to the battery, as the ’protected’ part is the cable between the resistor and the unit.
This will prevent the +RTC wire from powering up the unit if shorted to +BAT.



Connecting the emergency stop and voltage supply.

NOTICE
Do not use the chassis as the negative terminal.

Polarity reversal

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

Addressing/terminating

IQAN-MC31 use of an ID-Tag

In IQANdesign 3.0 and higher software, more than one IQAN master module can be used together in a multi-master system. The master modules are each given a unique address by using an ID-Tag. The value of the ID-Tag identifies the master and will enable a single project application to be loaded into more than one master module over the CAN bus. The functionality needed for each master is loaded based on the ID-tag address.

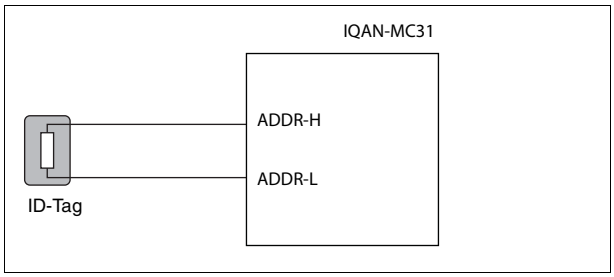
Identification of an IQAN-MC31 by address

For normal operation of an IQAN-MC31 in a single master system, the ID-Tag is still used. When no ID-Tag is installed the MC31 or if the ADDR pins are jumpered on power up, the MC31 will start in safe mode.

The connection of an ID-Tag between ADDR-H and ADDR-L will assign an address to the IQAN-MC31 master module. The desired functionality based on address is built into the project file using IQANdesign software. For more information, please refer to the IQANdesign user manual.

It is the combination of *address* and *type* that gives each master module a unique identification. The maximum number of MC31 addresses is 8, denoted as addresses 0, 1, 2, 3, 4, 5, 6, 7 respectively.

In order to assign any IQAN-MC31 an 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, the MC31 is terminated internally on all of its CAN buses. When an IQANdesign application is loaded, it can set individual buses to be non-terminated.

To give an IQAN-MC31 a unique address, you may use an addressing ID-tag, or an ID-tag having a combined address and terminating function. The ’T’ values of ID-tags are ignored, i.e. an ID-tag 3T is equivalent to ID-tag 3.

If the module is located at the end of the CAN-bus, then leave the bus default terminated in the MC31.

NOTICE

The CAN-bus should not be terminated at the MC31 using an external regular terminating resistor, due to the fact that terminating is made from within the MC31 module by default.

Diagnostic interfaces

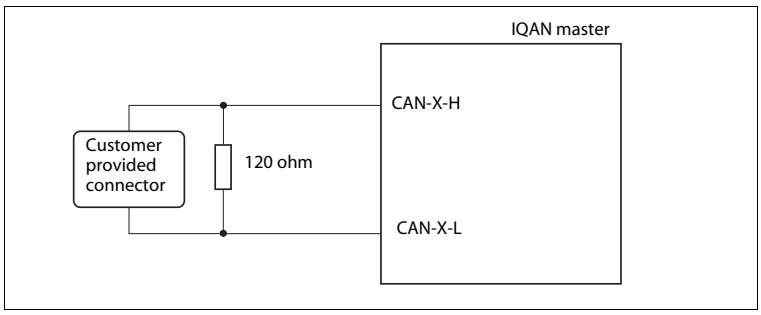
IQAN software includes many tools for tuning, measuring, accessing logs and otherwise checking the performance or troubleshooting your control system. To use the diagnostic tools with an IQAN master module you may choose between different ways to connect to the unit.

CAN diagnostics connection

One of the CAN buses of the IQAN master module may be dedicated for diagnostics. Reserving a bus for diagnostics ensures that signals are not interrupted by other bus traffic. A high-speed CAN interface is needed to use this feature. Contact Parker for information about supported CAN interfaces.

A termination resistor is usually required at the CAN interface on the PC. Parker part number 5030082 or 5030182, or an equivalent 120 ohm resistor may be used. A flying lead cable may be connected to the IQAN master to provide a connector interface. The connection from IQAN master module to diagnostic CAN interface can then be made quite easily. It is recommended that the connector be a sealed, automotive type. When not being used this connector should be protected from the environment with a cover or mating blank plug.

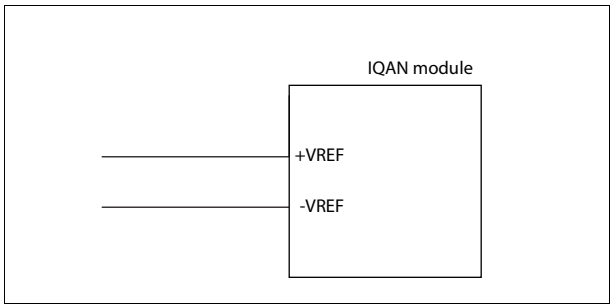
The recommended wiring to the IQAN master module connector is shown below.



Connecting for CAN communication.

Reference voltage, VREF

The IQAN 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

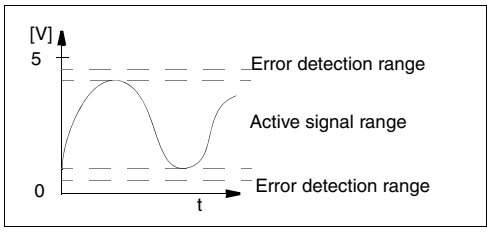
It is strongly recommended to use the module's -*VREF* and +*VREF* to all sensors and potentiometers that are connected to the module inputs. This will reduce bad measurement based on potential fault (i.e. different ground points for other supplies in relation to the IQAN module ground, -BAT).

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

Voltage inputs

Connecting sensors to the voltage inputs

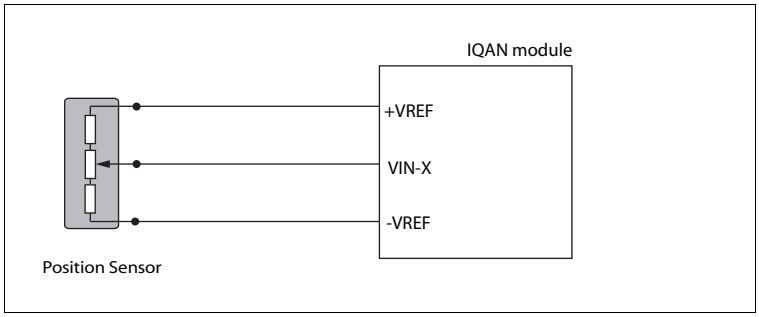
The sensor signal range must be 0-5 Vdc. To detect signal errors such as short circuits or interruptions the active signal range be within 0.5-4.5 Vdc.



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, and -VREF, respectively. Then connect the sensor signal to VIN-X.



Connecting VREF and sensor signal VIN-X.

NOTICE
The negative terminal of the sensor must not be connected to the chassis.
Maximum load for VREF position: see Appendix A.

Connecting other 3 wire sensors

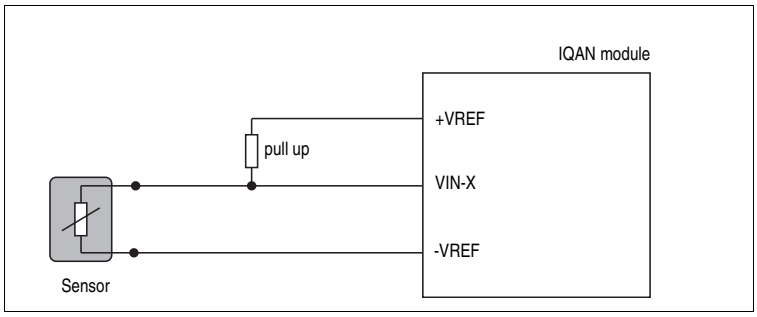
The same type of connection shown for potentiometers is used for other 3 wire sensors supplied with power from the regulated 5VDC supply, VREF. This includes active temperature sensor IQAN-ST, pressure sensor IQAN-SP and Hall-effect levers IQAN-LST or IQAN-LSL.

Connecting a 2-wire temperature sensor to voltage in

When you connect a PTC (positive temperature coefficient) 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 temperature sensor to -VREF, and the signal to VIN-X. The pull up resistor will be connected between VIN-X, and +VREF.



Connecting -VREF and temperature sensor signal VIN-X.

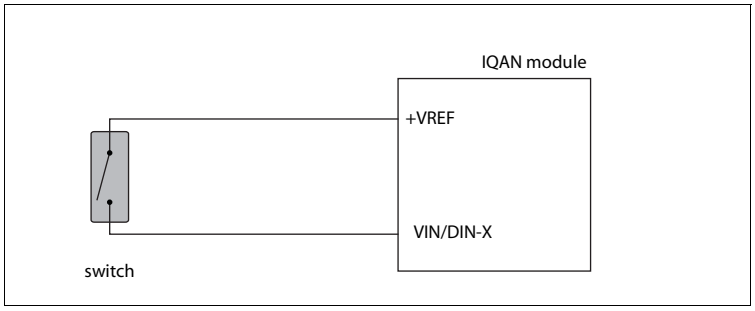
The pull up resistor value for a R_{25}=2000Ω, PTC sensor is 4,7 KΩ.

Connecting switches to the voltage inputs using VREF

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, and VIN-X, respectively.



Connecting a switch to VIN-X and VREF.

NOTICE

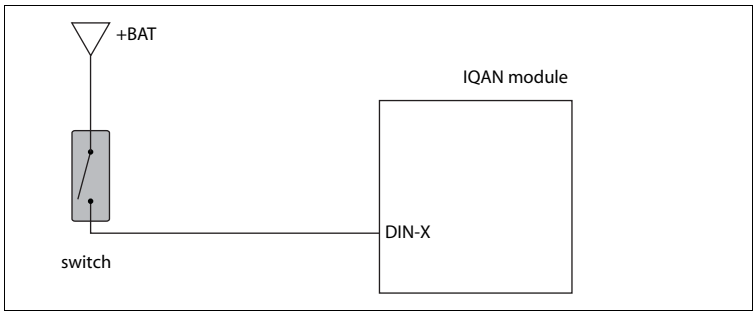
Maximum load for VREF position, see "Appendix A".

Connecting switches to the voltage inputs using +BAT

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, and DIN-X, respectively.



Connecting a switch to DIN-X and +BAT.

Digital inputs

DIN that share pins with VIN

These digital inputs share pins with the module voltage inputs and have high impedance characteristics. The preceding switch examples apply to these inputs.

DIN that share pins with CRET

These digital inputs share pins with the return pins of the proportional output channels, e.g. CRET and PWMRET. These pins have an internal power clamping diode. If used as inputs they must be connected in a way that prevents ’backending’, that is, supplying power to the module from a source other than its power pin (+BAT).

Carefully read the following section for more information.

Connecting switches to the digital inputs

When connecting switches to the digital inputs, DIN, that share pins with CRET, extra precautions should be taken.

WARNING

The DIN that share pins with the CRET positions of the proportional outputs have a possibility of ’backending’ the IQAN module when using those pins as digital inputs. The internal circuitry has power clamping diodes between CRET pins and the internal power supply. This arrangement creates a risk of inadvertently supplying power to the unit.

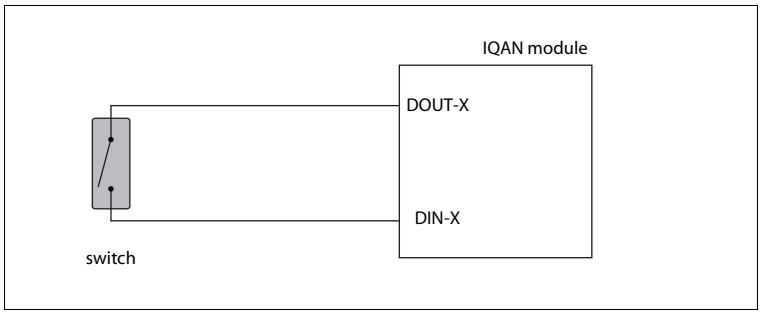
You can safely connect using +VREF for the supply, as shown in the preceding *"Connecting switches to the voltage inputs"* example.

If you would like to preserve +VREF for sensors and joysticks, then there are two additional methods:

1 The switches could be powered by one of the module’s DOUT pins.

EXAMPLE

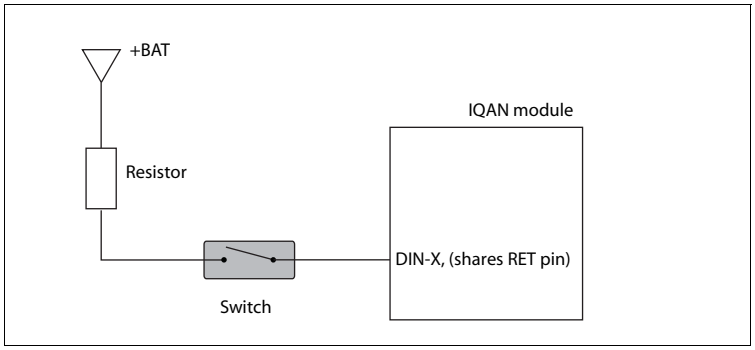
Connect the supply of the switch to DOUT-X, and the signal to DIN-X , respectively.



Connecting a switch to DOUT-X and DIN-X.

2 The switch supply could be connected through a high impedance resistor.

EXAMPLE
Connect the supply of the switch to +BAT through a high impedance resistor, and the signal to DIN-X , respectively.



Connecting a switch to DIN-X and supply through a resistor.

WARNING
Do not exceed 35Kohm for 12 Vdc systems and 50Kohm for 24 Vdc systems!
The DIN signal will not be detected by the module.
Remember that these flexible I/O pins must be configured in pairs of the same type.

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.

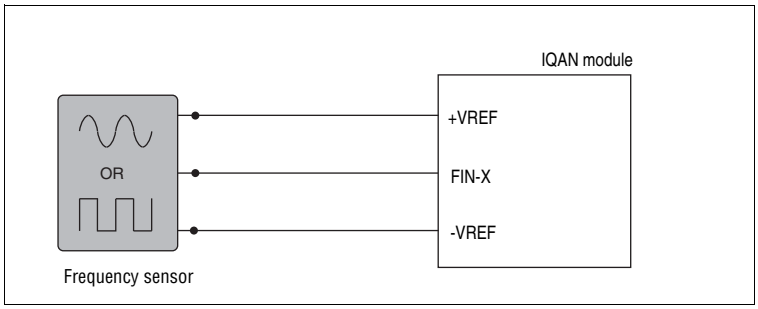
Simple frequency sensor

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, and -VREF, respectively. Then connect the sensor signal to FIN-X.



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.

Proportional outputs

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

Frequency

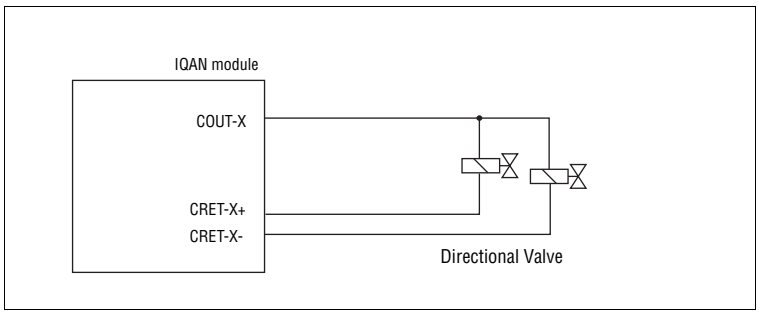
To obtain the best performance from proportional valves the controller produces a current mode (closed loop) output signal or a PWM mode (open loop) output signal. The type of output is selectable in IQAN software. The module has an adjustable frequency which can be changed using IQAN software. For the possible frequencies, see Appendix A.

Connecting loads to proportional COUT outputs

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

EXAMPLE

Positive direction:
Connect the proportional valve to the COUT-X, and the CRET-X+, respectively.
Negative direction:
Connect the proportional valve to the COUT-X, and the CRET-X-, respectively.



Connecting a load to a proportional output.

NOTICE

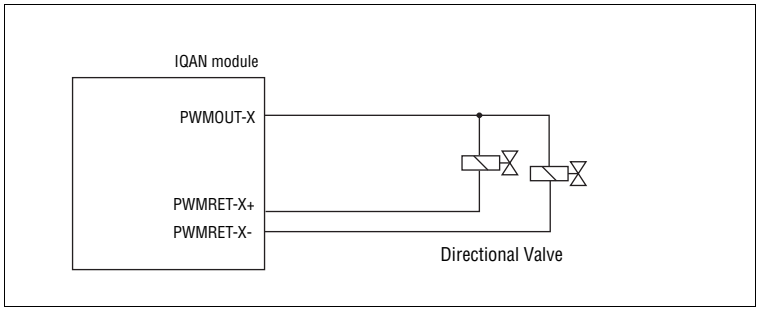
DO NOT install diodes across coils for COUT mode! (In COUT mode an internal clamping diode is used).

Connecting loads to proportional PWMOUT outputs

Connecting a load, e.g. one proportional valve section, to the PWM mode outputs is done by using the PWMOUT/PWMRET paired positions.

EXAMPLE

Positive direction:
Connect the proportional valve to the PWMOUT-X, and the PWMRET-X+, respectively.
Negative direction:
Connect the proportional valve to the PWMOUT-X, and the PWMRET-X-, respectively.



Connecting a load to a proportional output.

NOTICE

DO NOT install diodes across coils for PWMOUT mode for Parker Pulsar solenoids!

NOTICE

DO install diodes across coils for PWMOUT mode on all other solenoids!
If maximum load inductance is exceeded, or if PWM outputs are externally grounded, a clamping diode must be used. Place the diode between the PWMOUT and PWMRET, or the PWMOUT and ground, as close to the load as possible. This protects the output against high voltage transients.
For example, use diode: 1N5408 (3A/1000V).
Depending on the load, other clamping diodes might be used instead.

Digital outputs

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

Connecting loads to digital outputs

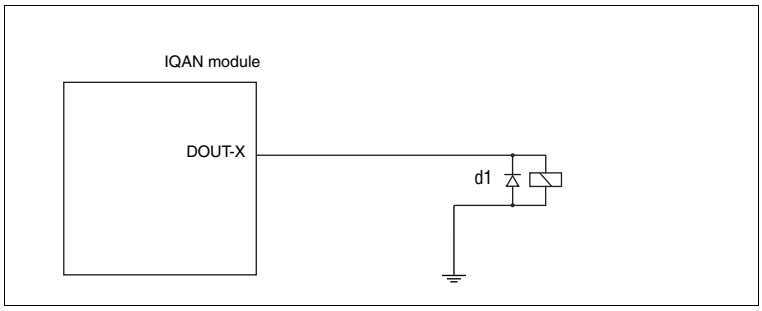
Connecting of loads to the digital outputs such as on/off valves is done by using the DOUT positions and the negative battery terminal as ground.

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.
For example, use diode: 1N5408 (3A/1000V).
Depending on the load, other clamping diodes might be used instead.

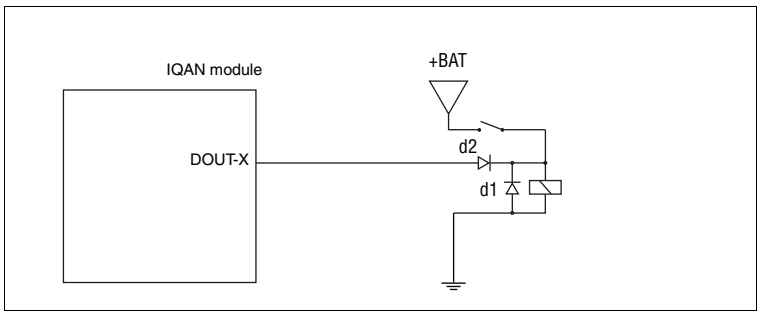
EXAMPLE
Connect the on/off valve to the digital output using the DOUT-X, and the negative battery terminal as ground.

NOTICE
A clamping diode must be placed as close to the load as possible



Connecting a load to the digital output.

NOTICE
If the load is controlled in parallel with another system, the digital output pin must also be protected with a second 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.

Connecting loads to low-side digital outputs

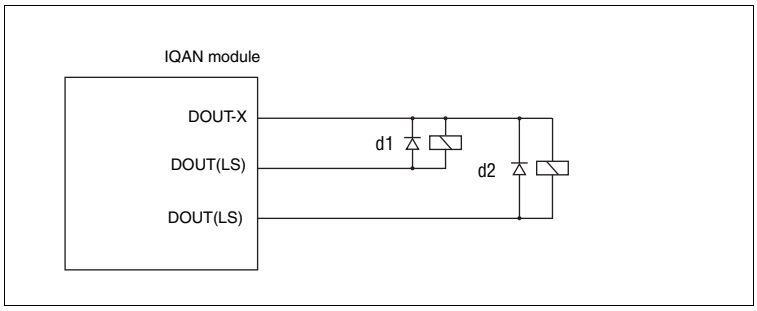
Connecting of loads to the low-side digital outputs such as on/off valves is done by using the DOUT(LS) positions and one or more DOUT channels as supply.

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.
For example, use 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 a pair of the DOUT(LS) positions, and the DOUT-X, 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.

WARNING

Loads on DOUT with Low-Side switch (DOUT[LS]) must always be controlled on the high-side by connection to a digital output with High-Side switch (DOUT-X) 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.

Diagnostic digital outputs

The IQAN-MC31 has two types of digital outputs. When used in pairs, high-side + low-side, diagnostics may be performed. DOUT A-E are the designations for the paired DOUT channels. DOUT-A = DOUT-F (HS) + DOUT-K (LS) and so on. For current ratings on the DOUT's, see Appendix A.

Connecting loads to diagnostic digital outputs

Connecting of loads to the digital outputs such as on/off valves is done by using the DOUT (HS)/DOUT (LS) paired positions.

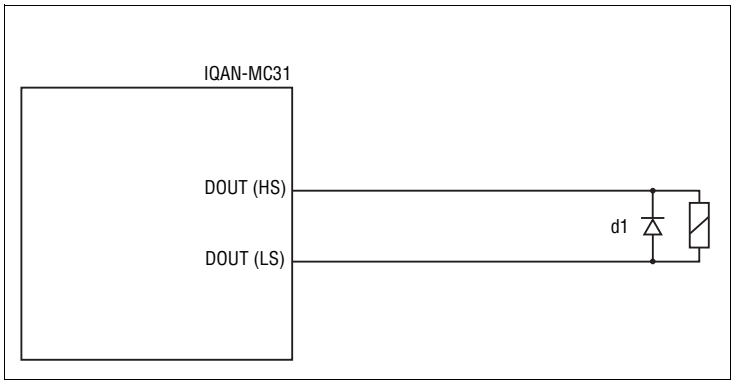
Protection against voltage transients

A clamping diode must be placed between the digital output (HS) and digital output (LS), as close to the load as possible. This reduces EMI, it also helps in protecting 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 (HS) and the DOUT (LS) as return, respectively.



Connecting a load to the diagnostic digital output.

DOUT output diagnostics

The diagnostic DOUT is capable of detecting internal faults as well as wiring faults. The fault will be identified as one of the following status values in IQANdesign.

- Over load (e.g. over current)
- Open load (e.g. open circuit or under current)
- "Error - internal error in the IQAN-MC31 power driver

The reported status is describing the most likely fault condition, but in certain cases the status will not match the actual fault. For details on failure modes, see Appendix B.

There are faults that are detected on startup, and that will prevent the module from starting the application. These are all faults where an output is connected to +BAT on startup.

To detect these faults, it is important that all connectors are plugged-in before the module is started. See section Start-up, also see Appendix B.

7 Start-up

Start-up procedures

This chapter contains instructions for action to be taken in connection with the initial start.

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 an emergency stop is installed.
  The emergency stop should disconnect the supply voltage to all modules. 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 power/status diode shall be illuminated on all modules. Also, make sure that the master is in contact with all modules by reading the master's display.
- Make sure the emergency stop is functioning properly.

Start the system

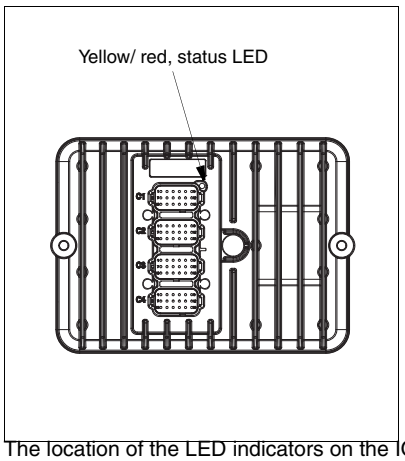
Start the system as follows:

- 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.

8 System Diagnostics

The yellow blinking LED on the top of the module indicates normal status. If there is an error detected, the IQAN module will indicate *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 module.

The yellow/red LED, will be blinking red when an error has been detected. To get further information about the error messages, see Appendix B.

Safe mode

If the ADDR_L voltage > 3.00V (ADDR_L pin shorted to ADDR_H) is detected when the module starts (during power up) the application will not be loaded. This is a special start-up mode that is used for master modules and puts the unit in a safe state without starting any application.
When ’safe mode’ is desired, a jumper is put across pins 1 and 14 on the MC2 and 7 and 8 on the MC3/MC31, in place of an ID-Tag. The MC3/MC31 will also start in safe mode if the ID-Tag is absent.

Appendix A

IQAN-MC31 Technical Overview

Absolute Maximum Ratings[a]

Ambient temperature,	-40 to +85 °C
Storage temperature	-40 to +100 °C
Voltage supply on +BAT	6 to 36 Vdc
Voltage on any pin with respect to -BAT	36 Vdc
Power driver load	Total load on power drivers < 20A

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

Climate environment	
Enclosure, water & dust protection	IEC 60529:2001, IP67; DIN 40050 Part 9:1993, IP6K9K
Salt mist	IEC 60068-2-52:1996 Kb, 72 h
Damp heat, cyclic	IEC 60068-2-30:2005 Db, +55°C, 95% RH, 6 cycles
Damp heat, steady state	IEC 60068-2-78:2001 Cab, +40°C, 93% RH, 21 days
Heat, operation	IEC 60068-2-2:2007 Bb, +85°C, 72 hours
Heat, storage	IEC 60068-2-2:2007 Bb, +100°C, 72 hours
Cold	IEC 60068-2-1:1993 Ab, -40°C, 16 hours
Change of temperature	IEC 60068-2-14:1984 Nb, - 30°C to +70°C, 100 x 4 hours
Mechanical environment	
Random vibration	IEC 60068-2-64: 2008 Fh, 10 - 1000 Hz, 11.6 Grms, 3 x 10 h
Bump	IEC 60068-2-27:2008 Ea, 40 g, 6 ms, 1000 * 6 dir
EMC	
Radiated emission	ISO 13766/ISO 14982
Conducted emission	EN 55025:2003, 0.15-108 MHz, Class 1
Conducted susceptability	ISO 11452-4:2005, 1 - 200 MHz, 1 kHz, 80% AM, 100 mA
Radiated susceptability	ISO 11452-2:2004, 200-2000 MHz, 1kHz, 80% AM, 100 V/m
Conducted transients susceptability	ISO 7637-2:2004, Pulse 1,2a,2b,3a,3b,4,5, Level 3 ISO 7637-3:2007, Level 3
ESD, operation	ISO 10605:2008, 8kV (contact), 15kV (air)
ESD, handling	ISO 10605:2008, 8kV (contact)

Markings/Approvals

CE	2004/108/EC, EMC directive 2011/65/EU, ROHS 2

System

T_A = -40 to +85 °C (unless otherwise specified)

Weight	1.1 kg
Ambient temperature, T_{ROC}	-40 to +85 °C
Voltage supply on +BAT, V_{BAT}	9 to 32 Vdc
Current supply V_{BAT} =14V V_{BAT} =28V	 typ. 250 mA typ. 170 mA
Start up time	typ. 1000 ms (with a small application)
System cycle time, T_{SC}	3 to 100 ms
Application flash memory	1536 KB
Application RAM memory	1728 KB
Data log memory	typ. 80,000 records

Sensor supply, VREF

Number of VREF	2
Output voltage	5 V ±150 mV, -40 to 85 °C
Output voltage temperature drift	0.25 mV/°C, -40 to 85 °C
Maximum load current	140 mA on each VREF
Protection	overload, SCB, SCG
Diagnostics	over/under voltage
Under/over voltage threshold	±150 mV from nominal value

Signal input, VIN

Number of VIN	16
VIN full scale	5000 mV ±100 mV
VIN resolution	12 bits = 1.22 mV
Input impedance	36 kohm in parallel with 10 nF
Accuracy *with external sensor supply* *with VREF sensor supply*	 ±(0.8 % + 5 mV) ±(0.2 % + 5 mV)
Sample rate	same as system cycle time
Maximum continuous voltage	5.5 V
Protection	SCB, SCG

Signal input, DIN

Number of DIN	16 (configuration may reduce number)
Logic levels *low* *high* *hysteresis*	 <1 V >4 V >0.1 V
Input impedance	6.8 kohm in parallel with 10 nF
Sample rate	same as system cycle time T_{SC}
Maximum continuous voltage	32 V
Diagnostics	Defined in application

Signal input, FIN/DFIN

Number of FIN/DFIN	8/4 (configuration may reduce number)
Frequency range *FIN* *DFIN*	 1 to 20,000 kHz, 50% duty cycle 1 to 20,000 kHz, 50% duty cycle
Minimum pulse width	10 µs for 5 V signal
Step response	400 ms, 10 to 90% step
Logic levels *low* *high* *hysteresis*	 <1 V >4 V >0.3 V
Input impedance	6.8 kohm in parallel with 10 nF
Sample rate	same as system cycle time T_{SC}
Maximum continuous voltage	32V
Diagnostics	Defined in application

Signal input, PCNT/DPCNT

Number of PCNT/DPCNT	8/4 (configuration may reduce number)
Frequency range *PCN* *DPCN*	 0 to 20,000 kHz 0 to 20,000 kHz
Minimum pulse width	10 µs for 5 V signal
Logic levels *low* *high* *hysteresis*	 <1 V >4 V >0.3 V
Input impedance	6.8 kohm in parallel with 10 nF
Sample rate	same as system cycle time T_{SC}
Maximum continuous voltage	32 V
Diagnostics	Defined in application

Power driver, COUT

Number of COUT	4 dual outputs
COUT range *low* *high*	 100 mA 2000 mA
COUT resolution	1 mA
Power driver voltage drop *750 mA load* *1500 mA load*	 typ. 0.45 V @ saturation typ. 0.90 V @ saturation
Maximum COUT saturation	typ. Command -25%
Absolute accuracy	±(2 % + 15 mA) , -40 to 85 °C
Dither frequency, F_{DITH}	71, 77, 83, 90, 100, 111, 125, 167, 200, 250, 333 Hz
Leakage current in OFF state	<100 µA
Supply rejection	±2 mA, V_{BAT} change 9 to 18V or 18 to 32V
Load rejection	±2 mA, load change ±50 %
Maximum load *VBAT = 14V and FDITH ≥ 200 Hz* *VBAT = 14V and FDITH ≥ 200 Hz* *VBAT = 14V and FDITH ≥ 200 Hz* *VBAT = 14V and FDITH ≥ 200 Hz*	 5 ohm + 10 mH 5 ohm + 20 mH 10 ohm + 30 mH 20 ohm + 60 mH
Maximum allowable load inductance *1.0 A load* *1.5 A load* *2.0 A load*	 500 mH 200 mH 50 mH
Protection	SCB, SCG
Diagnostics *Operational ON* *Operational OFF*	 under current, SCG, SCB open load, SCG
Open load threshold	>50 kohm when COUT is OFF
Under/over threshold	MaxOf ±100 mA and ±25 %

Power driver, PWMOUT

Number of PWMOUT	4 dual outputs
PWMOUT range	0% to 100% -200µs
PWMOUT resolution	1 µs
Power driver voltage drop	typ. 0.8 V @ 1.5 A load
Dither frequency, F_{DITH}	71, 77, 83, 90, 100, 111, 125, 167, 200, 250, 333 Hz
Leakage current in OFF state	<100 µA
Maximum load	2A
Maximum allowable load inductance *1.0 A load* *1.5 A load* *2.0A load*	 500 mH 200 mH 50 mH
Protection	SCB, SCG
Diagnostics *Operational ON* *Operational OFF*	 SCG, SCB open load, SCG
Open load threshold	>50 kohm when PWMOUT is OFF

Power driver, DOUT

Number of DOUT high-side low-side	 5 5
Maximum load *DOUT-A to C (high-side)* *DOUT-D to E (high-side)* *DOUT-F to H (low-side)* *DOUT-I to J (low-side)*	 3.0 A 2.0 A 3.0 A 2.0 A
Power driver voltage drop *DOUT-A to C (high-side)* *DOUT-D to E (high-side)* *DOUT-F to H (low-side)* *DOUT-I to J (low-side)*	 typ. 0.17 V @ 3 A load typ. 0.10 V @ 1.5 A load typ. 0.29 V @ 3 A load typ. 0.41 V @ 1.5 A load
Leakage current in OFF state *DOUT-A to C (high-side)* *DOUT-D to E (high-side)* *DOUT-F to H (low-side)* *DOUT-I to J (low-side)*	 <100 µA <100 µA <2 mA <100 µA
Maximum allowable load inductance DOUT-A to C, F to H *1.0 A load* *2.0 A load* *3.0 A load*	 500 mH 200 mH 50 mH
Maximum allowable load inductance DOUT-D to E, I to J *1.0 A load* *1.5 A load*	 500 mH 200 mH
Protection	overload, SCB, SCG
Diagnostics *Operational ON* *Operational OFF*	 no open load (DOUT-F to J only)
Open load threshold	>50 kohm or <100 µA when DOUT is OFF

CAN

Number of CAN buses	4
CAN specification	2.0A and 2.0B
CAN bus speed	125 kbit to 500 kbit
Protection	SCB, SCG

Appendix B

Error codes, messages and actions

If one of the following error is detected, a message will be presented 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.

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

LED indicator showing different MC31 modes

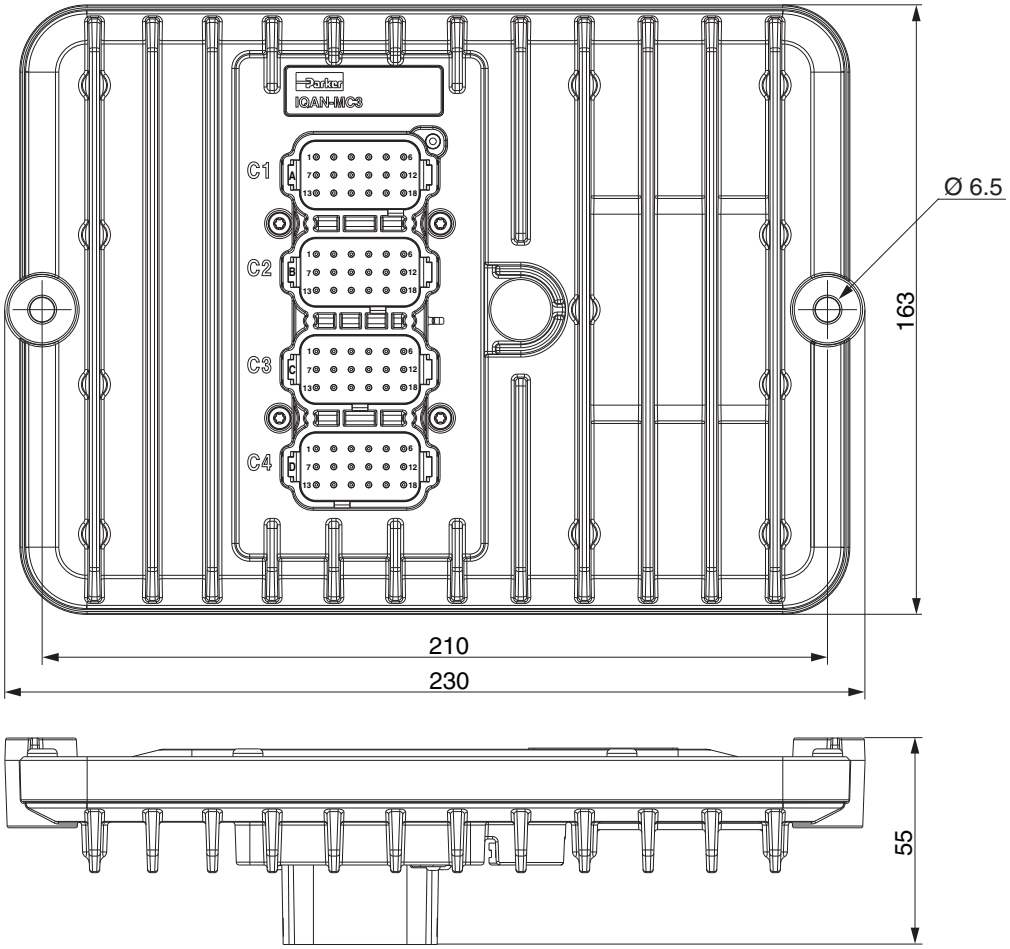
Status	Flash (yellow)
Normal operation	
Application not loaded	
No application available	
Waiting for restart	

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, no contact		
3:2	IDtag error		
3:3	System mismatch		
3:4	CAN error (bus off)		
4:1[a]	Internal error/OSE		

a. This is followed by a longer sequence of flashes, contact Parker.

Appendix C

Dimensioning of the IQAN-MC31 module



Unit = mm

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

Information in this instructionbook is subject to change without notice

Publ no HY33-8411-IB/UK
Edition 2017-01-25

Parker Hannifin
Electronic Controls Division
SE-435 35 Mölnlycke
Sweden
Tel +46 31 750 44 00
Fax +46 31 750 44 21
www.parker.com

Parker Hannifin
Electronic Controls Division
1651 N. Main Street
Morton, IL 61550
USA
Tel +1 309 266 2200
Fax +1 309 266 6674