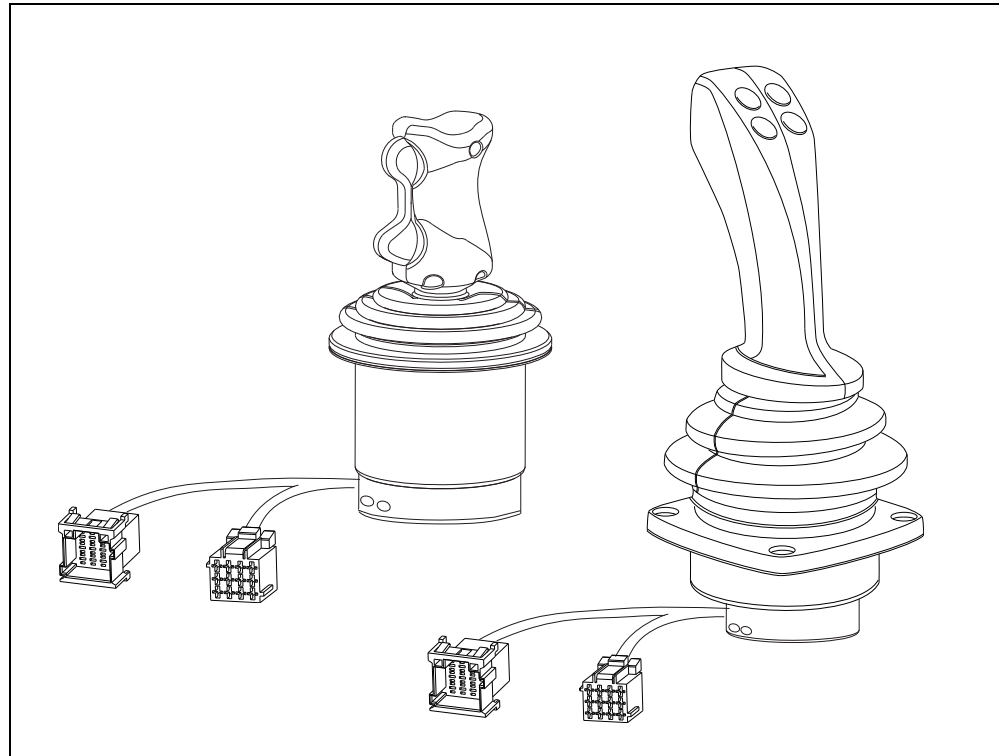


IQAN-Lx

Instruction book

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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.

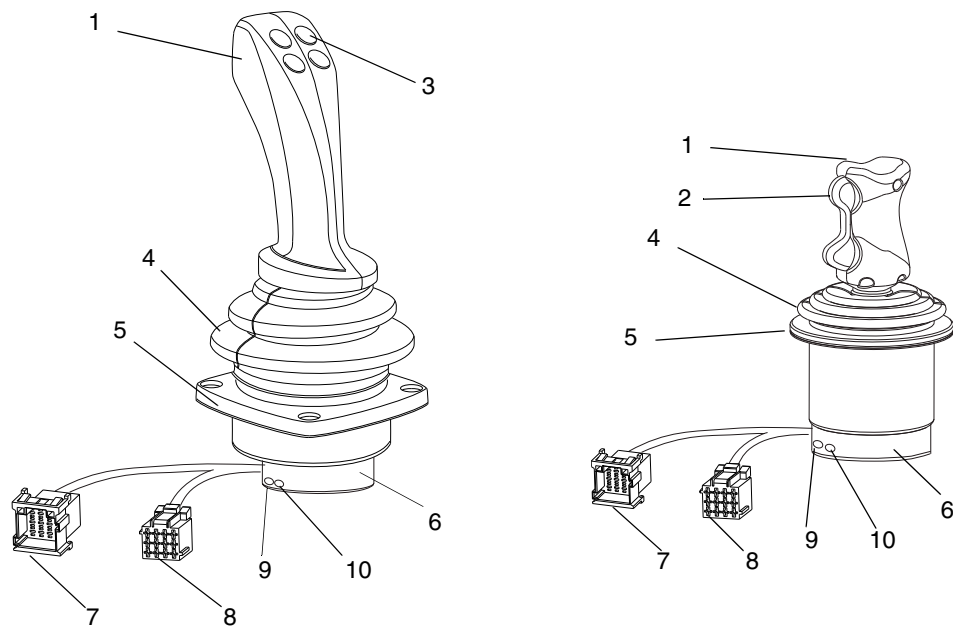
3 Product description

IQAN-LL/LM

IQAN joystick controllers come in two sizes:

- IQAN-LM is a smaller type of control lever (Lever, Mini)
- IQAN-LL is a larger type (Lever, Large)

The large and the small lever are the same in terms of signals and therefore both are called IQAN-Lx.



The IQAN-Lx module types.

The control lever's parts

Control lever -Lx consists of:

- 1 Handle
- 2 Rocker (Option)
- 3 Switch (Option)
- 4 Bellows
- 5 Mounting flange
- 6 Lower part
- 7 Connector C1 for CAN bus, supply voltage, address idTag.
- 8 Connector C2 for inputs and outputs.
- 9 Indicator for supply voltage.
- 10 Status indicator for IQAN-Lx.

The IQAN-Lx control signals

The IQAN-Lx is used to control the object in two or three directions:

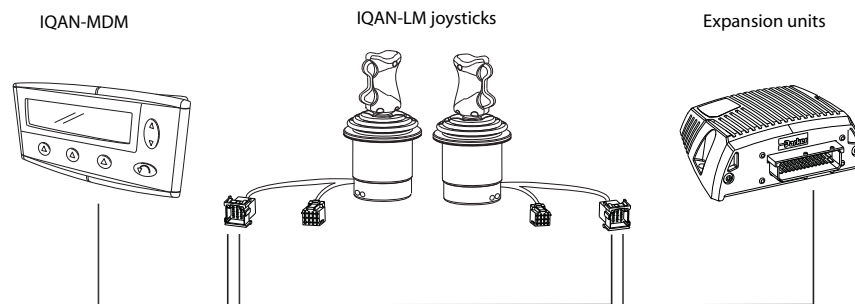
- the lever is moved to the right/left, direction X +/-.
- the lever is moved forwards/back, direction Y +/-.
- the rocker is moved upwards/downwards, direction Z +/-.

The control signal is proportional to the lever's working range.

The control signal is transferred internally from the IQAN-Lx via the CAN bus to the master unit. The control signal's data is treated in the system and is then available as an output signal, for example in the expansion unit IQAN-XT2. The IQAN-Lx can be equipped with a proportional rocker ("G" handle option for -LL, "D" handle option for -LM), or with buttons ("N" or "E" handle option for -LL).

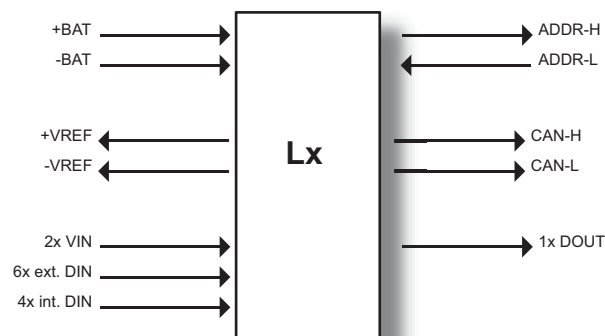
The following descriptions refer to a fully equipped lever, but is also applicable to the functions on levers with no rocker or buttons.

The IQAN-Lx are delivered with an outgoing cable that has 2 connectors for all inputs and outputs.



IQAN-Lx in a typical system

I/O overview



Inputs

The IQAN-Lx module has up to 4 internal digital inputs for buttons in the lever handle..

(4) Digital inputs DIN-G thru DIN-J (IQANdevelop software)

or

(4) Digital inputs DIN-I thru DIN-L (IQANdesign software)

There are five (5) *digital inputs* in the C2 connector for external signals..

(5) Digital inputs DIN-A thru DIN-E

The IQAN-Lx module has two (2) *voltage inputs* VIN-A and VIN-B for connection of 0-5 Vdc signals. These inputs can be configured as *digital inputs* with IQANdesign software for reading switches. *Voltage inputs* and *digital inputs* share positions, see below.

(2) Voltage inputs VIN-A, VIN-B

or

(2) Digital inputs DIN-G, DIN-H (IQANdesign software only)

Outputs

An IQAN-Lx may have 2 or 3 proportional lever directions, XY or XYZ.

There is one (1) digital output, DOUT-A This output can also be configured as a *digital input* with IQAN software. *Digital output* and *digital input* share positions, see below.

(1) Digital output DOUT-A

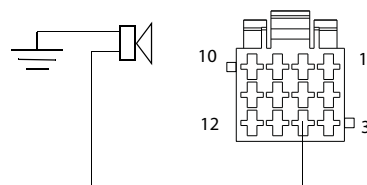
or

(1) Digital input DIN-F

The digital output, DOUT-A may be activated when there is an error message for the system, such as a short-circuit and input or output interruption. By connecting the digital output to a warning lamp or audio signal, the driver is alerted that an error message has been given.

Connection of DOUT

Connect the alarm (audio signal) between pin C2:6 and -BAT (the battery's negative pole). See the illustration below. An active output gives battery voltage (11-32 Vdc) to the pin. The maximum load is 200 mA.



Connection of DOUT as an alarm output.

CAN related functions

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

4 Safety

General

In order to fulfil high safety demands, the Lx module uses a real-time operating system for fault tolerant embedded systems. The Lx module has an internal watchdog function. If the watchdog detects any software errors, necessary precautions will be activated.

Polarity reversal

The Lx module is protected against power supply polarity reversal, provided an external fuse, max 3A (Fast) is being used. Polarity reversal can damage the unit if the fuse is not used.

CAN-bus interruption

The Lx 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 will present a related message on the display. The Lx module will also indicate the error with an error code ref., see page 9.

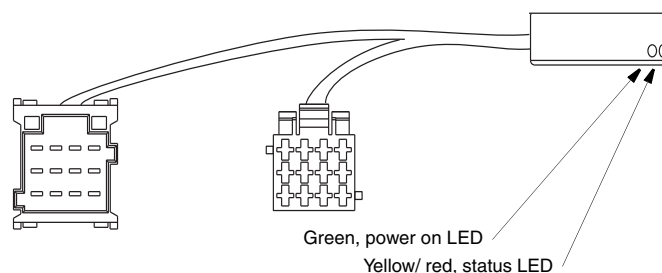
Input/ output Protection

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

System Diagnostics

The yellow blinking LED on the module indicates normal status. If there is an error detected, the master will present a message on the display. The Lx module also indicates *error status* through the red blinking LED as shown below.

This gives an immediate diagnosis as to the nature of the error that has occurred.



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

The green LED indicates power on. 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, on page xxvi

5 Mounting

Mounting the unit



NOTICE

The IQAN-Lx unit should be mounted according to the following instructions.

Mounting considerations

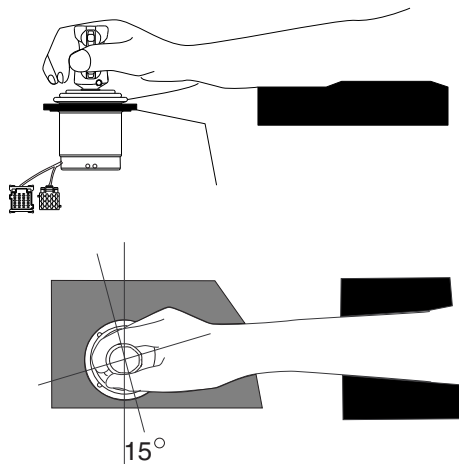
- The control lever must be built in so that it is protected against damp, dirt and mechanical damage.
- The machine manufacturer must consider the need of a protective catch, or similar, to prevent unintentional working of the lever



NOTICE

Take careful consideration when positioning the unit.

- Mount the unit so that it is not exposed to external heat, e.g. from the engine or heater
- Mount the unit so that the LEDs are visible
- Mount the unit so there is no risk that the harness can be folded, crushed, worn or damaged in any way
- Locate the harness so there is no pressure on the connector.
- Use ergonomics. The control lever should be mounted at a height so that there is no pressure on the driver's arm and shoulders. IQAN-LM should be mounted at an angle so that the driver's wrist is held normally. The IQAN-LL combined with moveable arm rests can provide good ergonomics.



Always consider ergonomics when installing hand controls.

- The control lever IQAN-LM with 3rd axis is intended to be positioned so that the rocker is manoeuvred with the thumb.

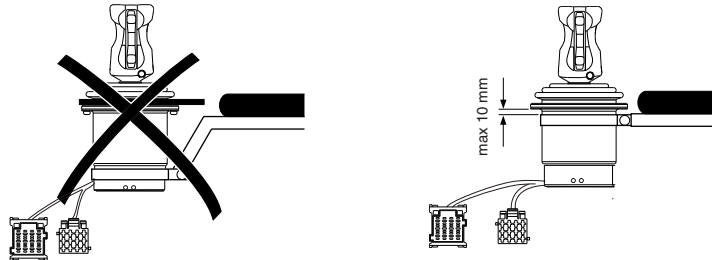
Mounting methods

- Control lever IQAN-LM can be mounted by screws into the flange or fastened with a clamp ring.



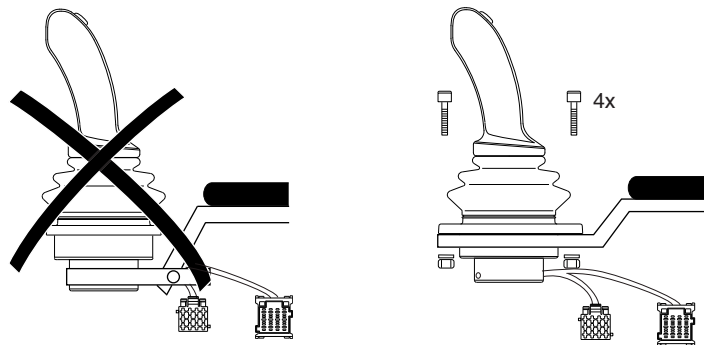
NOTICE

The clamp ring must be positioned a maximum of 10 mm under the flange.



Mounting the IQAN-LM with a clamp ring.

- Control lever IQAN-LL must only be mounted using screws through the flange.

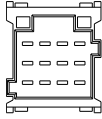
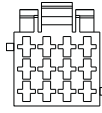


Mounting the IQAN-LL with screws.

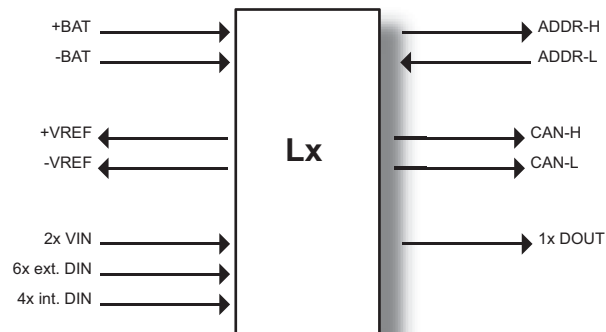
Please refer to the IQAN-Lx installation sheet for mounting dimensions.

6 Installation

Connectors C1 and C2

Connector kit	Parker 5031048		
Housing, C1	AMP no. 1-967627-1	C1	
Pin type	AMP no. 1062-20-0222		
Lock type	AMP no. 967632-1		
Housing, C2	AMP no. 1-967622-1	C2	
Pin type	AMP no. 2-963745-1		
Lock type	AMP no. 967632-1		
Recommended cable	0.75-1 mm ² (18 AWG)		
IQAN tool kit	Parker no. 5031061^a		

a.The IQAN tool kit description is found in the 'IQAN accessories' datasheet.



Connector pin assignments

Symbol	Pin No.	Input Output	Function
+BAT	C1:4 C2:9	-	Power supply
-BAT	C1:1 C2:12	-	Power supply
+BAT2	C1:5	-	Power supply
-BAT2	C1:2	-	Power supply
+VREF	C2:8	-	Voltage reference for external sensors. Sourcing +5V.
-VREF	C2:7	-	Voltage reference for external sensors. Return (0V).
CAN-L	C1:3	-	CAN high voltage bus line.
CAN-H	C1:12	-	CAN low voltage bus line.
CAN-L	C1:9	-	CAN high voltage bus line.
CAN-H	C1:6	-	CAN low voltage bus line.
ADDR-L	C1:7	-	Address
ADDR-H	C1:8	-	Address
I/O			Alternative functions or naming.
			IQANdevelop IQANdesign
DIN-A	C2:1	I	DIN-A DIN-A
DIN-B	C2:2	I	DIN-B DIN-B
DIN-C	C2:3	I	DIN-C DIN-C
DIN-D	C2:4	I	DIN-D DIN-D
DIN-E	C2:5	I	DIN-E DIN-E
DIN-F	C2:6	I/O	DOUT-A DOUT-A
VIN-A	C2:10	I	VIN-A DIN-G
VIN-B	C2:11	I	VIN-B DIN-H
DIN-G	internal	I	DIN-G DIN-I
DIN-H	internal	I	DIN-H DIN-J
DIN-I	internal	I	DIN-I DIN-K
DIN-J	internal	I	DIN-J DIN-L

Supply Voltage



CAUTION

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

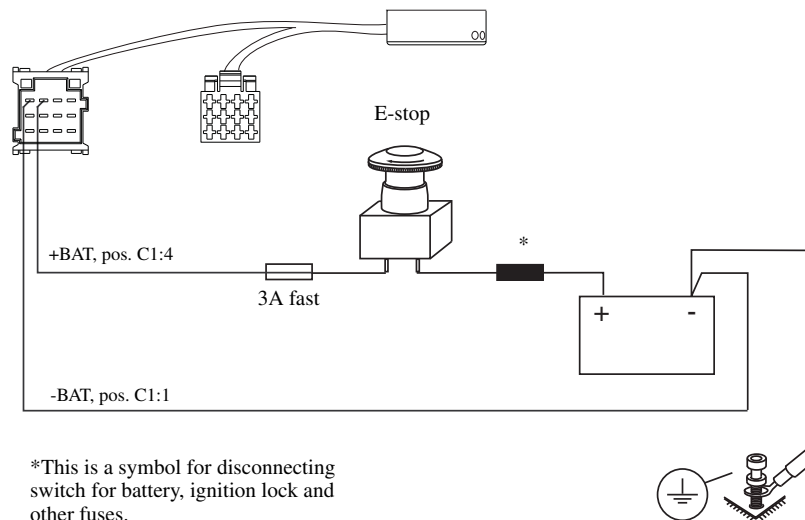
Emergency stop

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 range, see Appendix A, on page xxiii.

Connect the supply voltage to +BAT pin C1:4 through a fuse. The fuse shall be 3A fast (F). The ground connection is made from -BAT pin C1:1 to the negative pole on the battery.



Connecting the emergency stop and voltage supply.



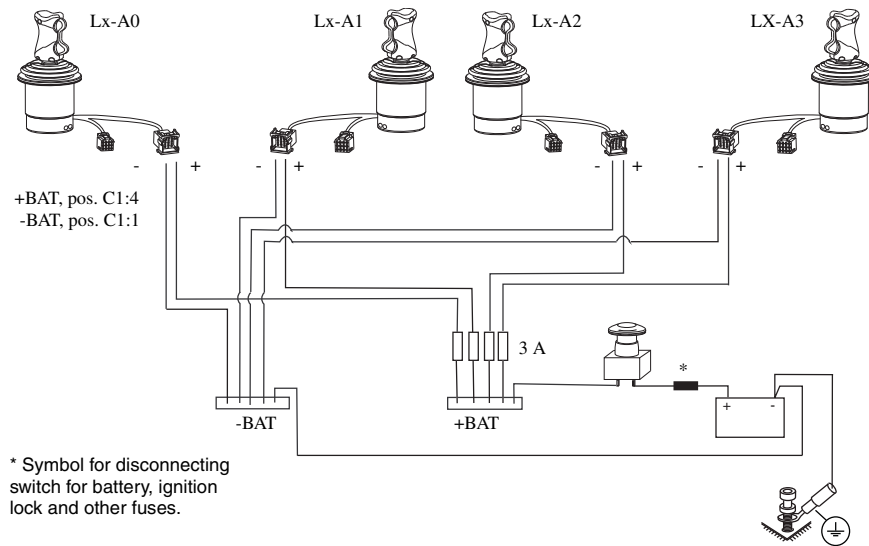
NOTICE

Do not use the chassis as the negative terminal.

Multiple modules connected to voltage supply

When connecting more than one Lx module, each of the units will have to be separately connected to the battery voltage and protected with a fuse. Requisite fuse level should be 3A, fast (F).

EXAMPLE



Connecting several modules to the power supply.

IQAN-Lx addressing/terminating

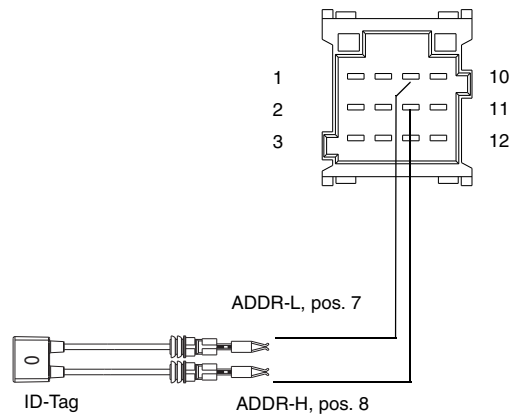
Addressing

Each Lx module will have a specific address, enabling the *master module* to communicate with the modules through the CAN-bus. When operating, the system distinguishes between different modules by first verifying the module type and secondly, through the modules having unique addresses.

EXAMPLE

If having an IQAN-Lx module with address 0, the system will denote this one as Lx-A0, The letter "A" refers to CAN-bus A.

The maximum number of similar modules in a system is four or eight depending on the master module, denoted in the first case as addresses 0, 1, 2, 3 respectively. In order to assign any Lx module a unique CAN-address, an *ID-Tag* will have to be connected to the positions ADDR-H and ADDR-L.



Connecting of Id-Tag in Lx connector.

Terminating

To eliminate interference in the communication, through the CAN-bus, the CAN-bus must be terminated. Because the master module always is located at the beginning of the bus, the master is provided with an internal termination.

You will only need to terminate the end of the bus.

If an IQAN-Lx is located at the end of the CAN-bus 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...

Selecting appropriate Id-Tag

- Check the address number of the module.
- If the module is located at the end of the CAN-bus then select the appropriate *ID-Tag* denoted with a "T".

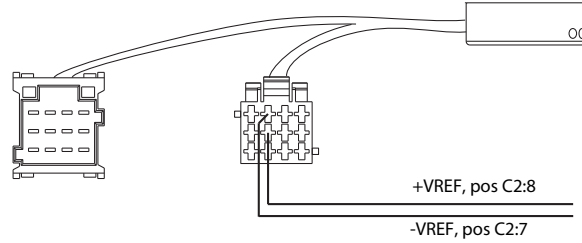


NOTICE

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

Reference voltage, *VREF*

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



VREF positions.



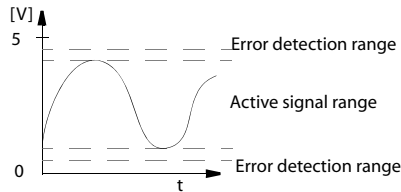
NOTICE

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

Connecting sensors and switches

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 is recommended to be within 0.5-4.5 Vdc.



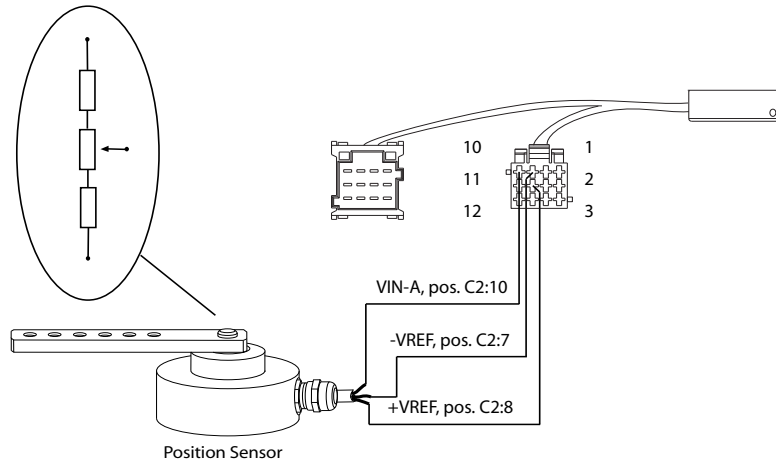
Active signal range.

The current consumption related to the voltage input is negligible.

The following describes the connection of any analog sensor. This includes temperature, pressure, angle and position sensors. 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. For a resistive type element, select the potentiometer value for the sensor to achieve the best linearity.

EXAMPLE

Connect the positive and negative terminals of the position sensor to +VREF, position C2:8, and -VREF, position C2:7, respectively. Then connect the sensor signal to VIN-A, position C2:10.



Connecting VREF and sensor signal VIN-A.



NOTICE

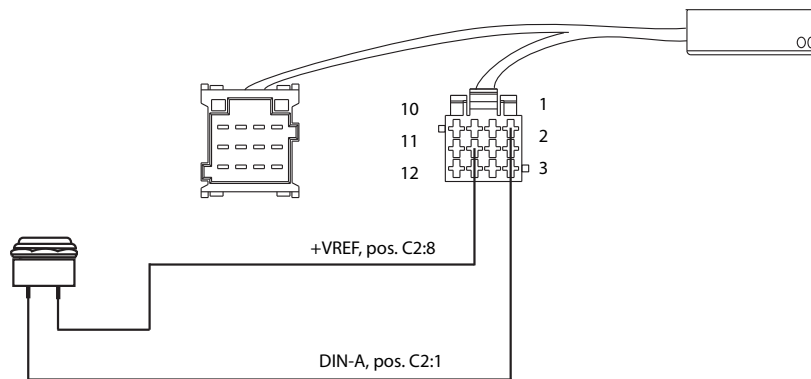
The negative terminal of the sensor must not be connected to the chassis. Maximum load for VREF position, see Appendix A, on page xxiii.

Connecting switches to the inputs

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

EXAMPLE

Connect the positive and negative terminals of the switch to +VREF, position C2:8, and DIN-A, position C2:1, respectively.



Connecting a switch to DIN-A and VREF.



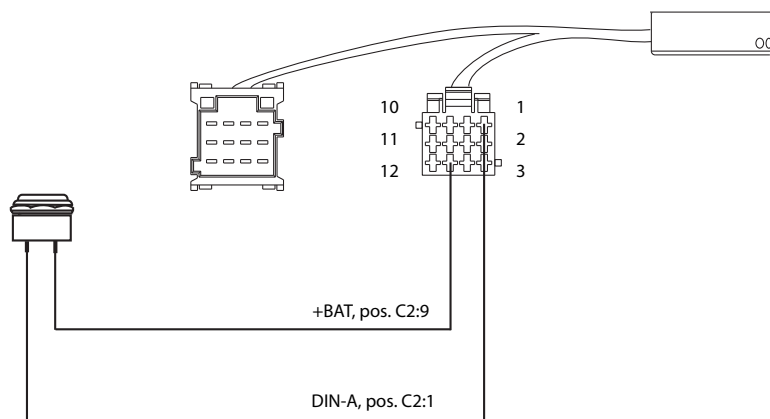
NOTICE

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

It is possible 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 C2:9 and DIN-A, position C2:1, respectively.



Connecting a switch to DIN-A and +BAT.

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 the emergency stop works.
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 green diode shall be illuminated on all modules. Also make sure that master is in contact with all modules by reading the master's display. Error messages are displayed 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 all mentioned preparations have been carried out and have 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-Lx Technical Overview

Absolute Maximum Ratings^a

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Ambient temperature, T_A	-40		+70	°C	
Storage temperature	-40		+100		
Maximum voltage supply on +BAT			34	V	Reverse polarity protected with 3A fuse.
Voltage on any pin with respect to -BAT			34	V	
Maximum current into -VREF			2	A	
Maximum current sourced by all outputs			400	mA	

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 won't have been shortened.

Environmental ratings

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
EMI EN 55022:1994 conducted emission EN 55022:1994 radiated emission ISO 11452-2:1995 ISO 11452-4:2001 ISO 7637-3:1995 ISO 7637-2:1990 EN 61000-4-8:1993			50 75 80 100	V/m mA V V A/m	class B, 0.15-30 MHz class B, 30-1000 MHz 20-1000 MHz 1-200 MHz 1a,2,3a,3b,4,
ESD ISO 10605:2001 15			15 6 4	kV	air contact handling
Mechanical environment IEC 68-2-64:1993 Fh IEC 68-2-29:1987 Eb			0.1 40	g^2/Hz g	15- 250 Hz, 10 hours 6 ms
Climate environment IEC 68-2-18:2000 Ra1 IEC 68-2-30:1985 Db IEC 68-2-3:1969 Ca IEC 68-2-2:1993-01 Bb IEC 68-2-1:1993-02 Ab IEC 68-2-14:1984 Nb			30 6 10 72 16 10 x 6	min cycles days hour hour hour	60mm/h +55°C, 95% RH 44°C, 93% RH 70°C -40°C -40°C to 70°C
Chemical environment IEC 68-2-52:1996 Kb			72	hour	

Recommended Operating Conditions^a

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Ambient temperature, T_A	- 40		+70	°C	
Voltage supply, V_{BAT}	11		32	V	
Total load on DOUT			400	mA	

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

$T_A = +25\text{ °C}$ (unless otherwise specified)

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Start-up delay		300		ms	Power to activated output
CAN message response time		9		ms	
Output voltage on VREF	4.9	5.0	5.1	V	load < 40mA
Maximum load current on VREF $V_{BAT}=11\text{V to }32\text{V}$			15 45 48	mA	Vdrop < 25mV (0.5%) Vdrop < 50mV (1%) Vdrop < 100mV (2%)
Current supply $V_{BAT}=14\text{V}$ $V_{BAT}=28\text{V}$		46 57		mA	outputs = off no load on VREF

I/O

$T_A = +25\text{ °C}$ (unless otherwise specified)

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
VIN (Voltage input)					
Signal range low		0	0.05	V	
Signal range high	4.9	5.0	5.1	V	
Input resistance		62		kΩ	
Signal resolution		5		mV	
Total unadjusted error	-35 -100		35 100	mV	VREF as source <40mA External source
DIN (On/off input)					
Input signal low			1.0	V	
Input signal high	4.0			V	
Trigg level, low level (0)		1.21		V	DIN-A to DIN-F
Trigg level, high level(1)		1.42		V	DIN-A to DIN-F
Input resistance		5.6		kΩ	

I/O

$T_A = +25\text{ °C}$ (unless otherwise specified)

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
DOUT (on/off output)					
Load current			400	mA	
Voltage drop ($V_{BAT} - V_{DOUT}$) load $I_L = 0.5\text{ A}$ load $I_L = 2\text{ A}$		0.2 0.8		V	
Off-State output current:			10	μA	
Max load inductance:			1000	mH	@ 400 mA
Short Circuit current limit		1.2		A	

Appendix B

Error codes, messages and actions

If one of the following errors are detected, a message will be presented on the master display together with an error code on the module. In some cases, the module will turn off, to increase safety.



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.

LOW/ HIGH SUPPLY VOLTAGE

Situation	Error code	Action Lx	Comment
+BAT < 8,5 V	Error 1	-	Check voltage supply
+BAT > 34 V	Error 1	-	Check voltage supply

VREF ERROR

Situation	Error code	Action Lx	Comment
VREF < 4,9 V	Error 1	-	Check voltage
VREF > 5,1 V	Error 1	-	Check voltage

MODULE IS OFFLINE

Situation	Error code	Action Lx	Comment
CAN-bus off	Error 3	All outputs shuts off.	Check CAN-bus
ADDR-H < 4,9 V	Error 5	-	Check voltage ADDR-H
ADDR-H > 5,1 V	Error 5	-	Check voltage ADDR-H
ADDR-L < 0,5 V	Error 5	During start up: The module turns off.	Check voltage ADDR-L
ADDR-L > 4,5 V	Error 5	During start up: The module turns off.	Check voltage ADDR-L
Software error	Error 6	The module turns off.	Contact supplier.

HIGH TEMPERATURE

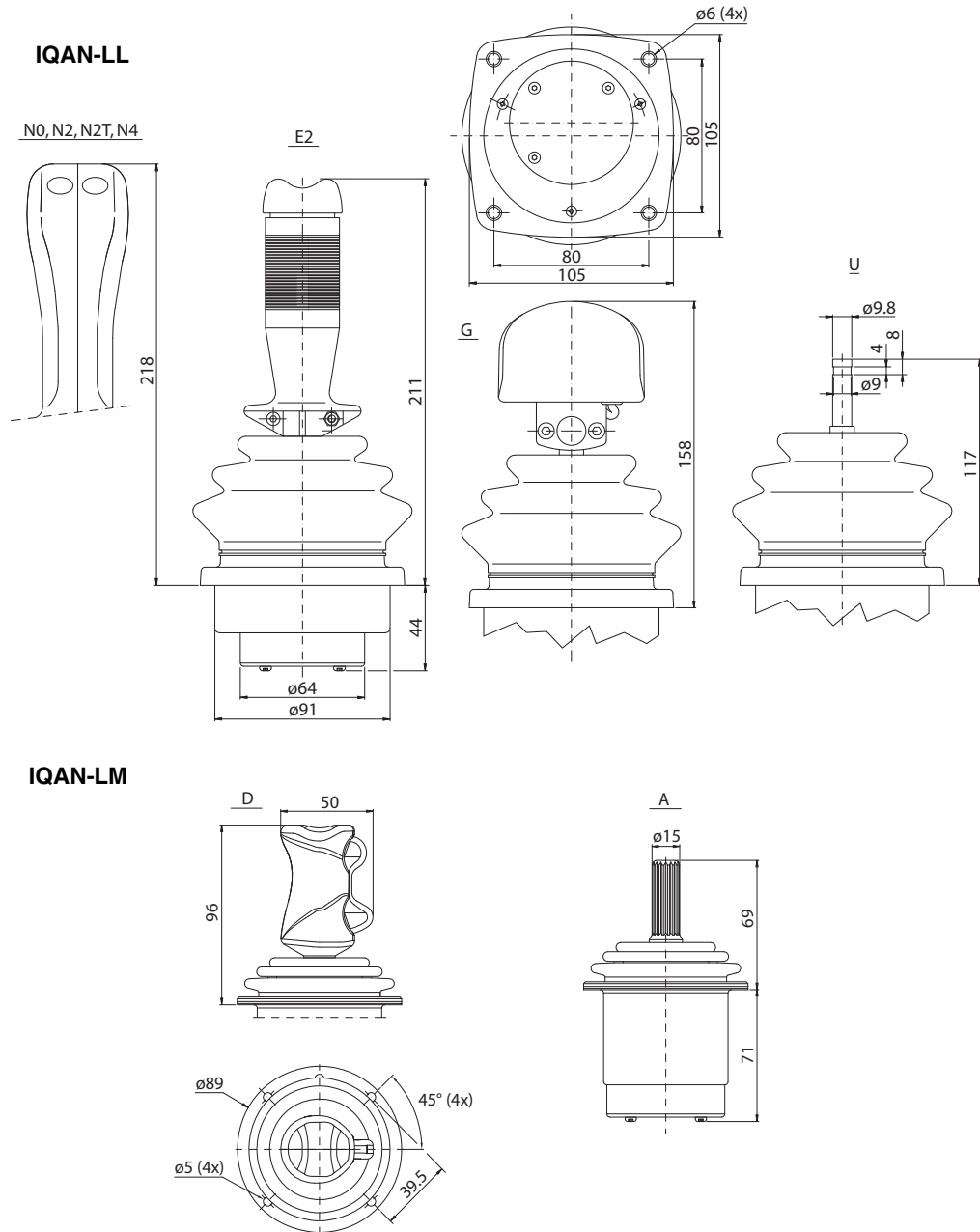
Situation	Error code	Action Lx	Comment
Internal temperature > max temp	Error 2	-	Check ambient temperature
Internal temperature sensor error	Error 4	-	Contact supplier

ERROR: PARAMETER AND INTERNAL

Situation	Error code	Action Lx	Comment
Parameter error	Error 6	No calibration of signals.	Contact supplier
Error ZP outer	Error 4	No calibration of signals.	Contact supplier
Error ZP inner	Error 4	No calibration of signals.	Contact supplier
Error _-axis	Error 4	All outputs shuts off.	Excessive force has been applied to end of stroke
Error Start block	Error 4	All outputs shuts off.	Check that Lx is centered during power-up

Appendix C

Dimensioning of the IQAN-Lx module types



unit = mm

For latest information visit our website www.iqan.com

Information in this instructionbook is subject to change without notice

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