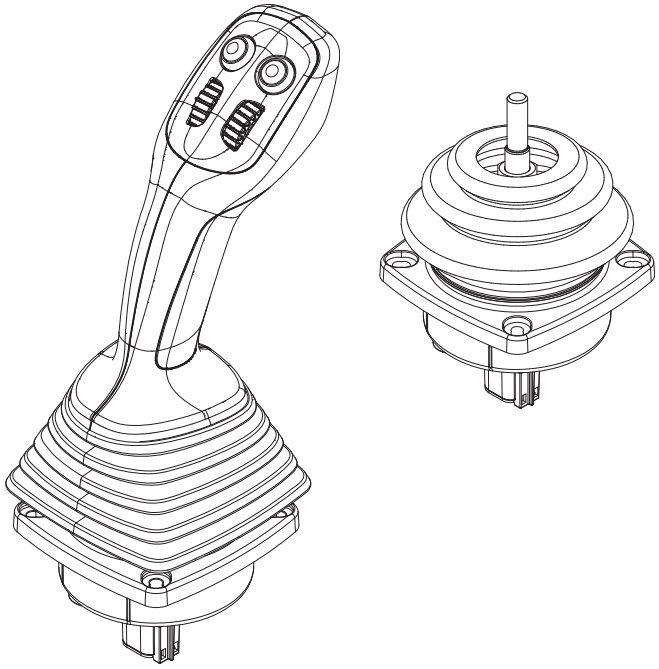
IQAN-LC5-X05
Instruction book

Publ no HY33-8402-IB/UK
Edition 2016-08-09



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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 labeled *WARNING* with a caution symbol in the left margin, indicate that a hazardous situation exists. If precautions are not taken, this could result in death, 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.

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

WARNING

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

WARNING

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

WARNING

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.

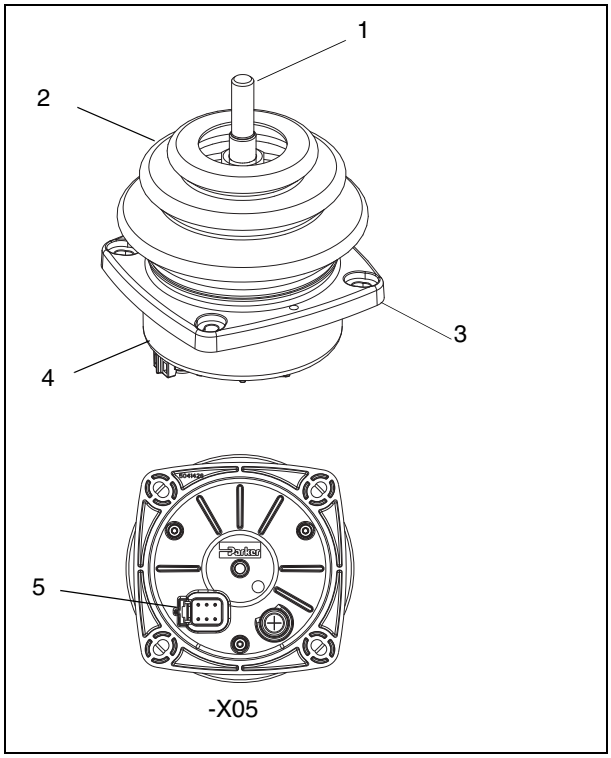
3 Product description

IQAN-LC5-X05

IQAN-LC5-X05 is a large, analogue output, coordinate lever.

The analogue joystick replaces ICL4 (fourth generation) levers and therefore is called IQAN-LC5 (**L**ever, **C**oordinate **5**th generation). The designation -X05 (**X** crossed outputs, **0** - **5** Vdc) represents the analogue output signals. The joystick has dual, mirrored outputs per axis in the 0-5V range

.



The IQAN-LC5-X05 parts.

The control lever's parts

Control lever -LC5-X05 consists of:

1 Stem, -U2 shown, no handle mounted.

2 Bellows, -U2 shown, no handle mounted.

3 Mounting flange.

4 Lower enclosure.

5 Connector C1 for supply voltage, primary and secondary analogue outputs.

NOTICE

In order to increase the safety of the LC5-X05, the opposing 10%-90% V_S and 90%-10% V_S analogue outputs can be compared e.g. to verify center position. With a 5 Vdc supply the outputs are typically 0,5-4,5Vdc and 4,5-0,5Vdc

The IQAN-LC5-X05 control signals

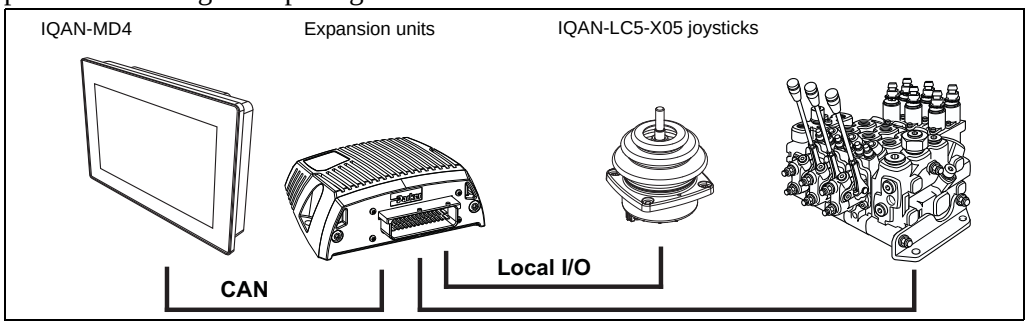
The IQAN-LC5 is used to control the object in two directions:

- the lever is moved to the right/left, direction X +/-.
- the lever is moved forward/back, direction Y +/-.

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

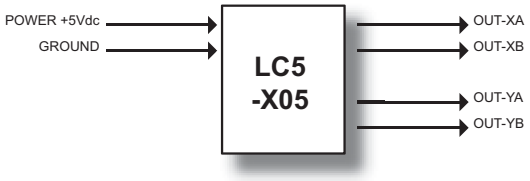
The control signal is transferred from the IQAN-LC5-X05 via a cable to the valve driver electronics (i.e. IQAN-TOC2), an expansion module, or IQAN master unit.

The IQAN-LC5-X05 base has one Deutsch DTM connector, (C1), with 6 positions for power and analogue output signals.



IQAN-LC5-X05 in a typical system

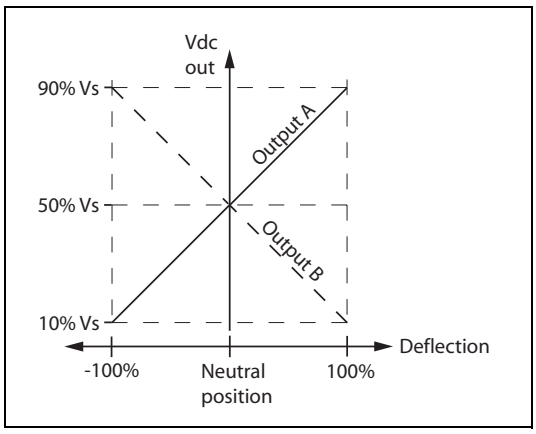
I/O overview, base



Outputs

The IQAN-LC5-X05 joystick has four (4) *analogue outputs* for use as command signals..

(2) Primary analogue outputs OUT-XA and OUT-YA, 10%-90% Vs
(2) Secondary analogue outputs OUT-XB and OUT-YB, 90% - 10% Vs



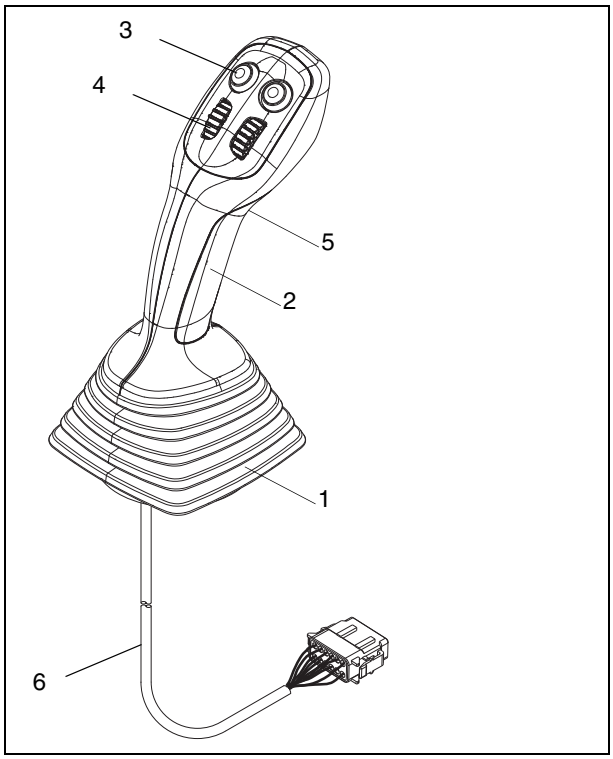
IQAN-LC5-X05 outputs per axis.

MP handle

The IQAN-LC5-X05 is designed to be used with the Multi-Purpose (MP) handle. The MP handle together with a IQAN-LC5-X05 base will have a Deutsch DTM connector for connection to external device (i.e., vehicle wire harness).

In order to reduce operator fatigue, the MP handle incorporates a hand rest, and is designed for both left and right-handed use.

To extend operating life the housing is made of a corrosive-free material, and is specially adapted for moisture drainage to protect the the system electronics. The MP handle uses a bellow that can be quickly changed to simplify field replacement. The cable between base and handle is routed directly through the base plate, eliminating the risk of damage and simplifying field service, while the use of a single circuit board and Hall effect sensors minimise the number of components and moving parts.



The IQAN-LC5-X05 parts.

The handle's parts

MP handle consists of:

1 Bellows, -MP handle.

2 Handle, -MPB2W2T1 shown, (other configurations are possible).

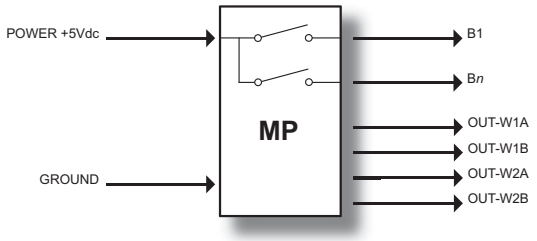
3 Momentary buttons.

4 Proportional thumbwheel (-MP handle thumbwheel has dual, mirrored outputs).

5 Momentary trigger button.

6 Cable and connector for -MP (6 pos. or 12 pos., depending on handle functions).

I/O overview, MP handle



Outputs

Digital

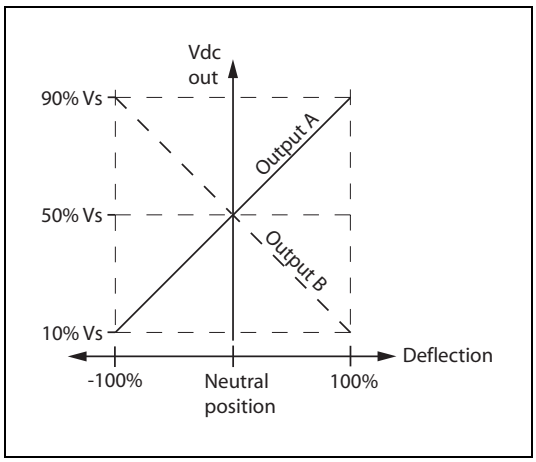
The IQAN-LC5-X05 MP handle has up to nine (9) *digital outputs* for use as command signals..

(8) momentary button outputs B1 thru B8
(1) momentary trigger button outputs T1

Analogue

The IQAN-LC5-X05 MP handle has up to four (4) thumbwheel *analogue outputs* for use as command signals..

(2) Primary analogue outputs OUT-W1A and OUT-W2A, 10%-90% Vs
(2) Secondary analogue outputs OUT-W1B and OUT-W2B, 90% - 10% Vs



MP handle outputs per thumbwheel.

4 Safety

IQAN-LC5-X05

Redundant signals

In order to fulfill high safety demands, the analogue joystick IQAN-LC5-X05 uses dual outputs per axis. The secondary output is the inverse or "mirror image" of the primary output. These outputs can be compared in the controller and used to detect faults.

Use of limited signal range

The analogue outputs of the IQAN-LC5-X05 use limited signal range to provide an additional method for error detection. The operating signal range for primary and secondary outputs are 10%-90% Vs and 90%-10% Vs respectively. Vs (power supply) is typically 5Vdc. This allows the controller to detect if a wire is pulled loose (open, result 0V) or making contact with a powered wire (short, result 5V or greater). Detecting wiring faults can protect against unintended movement.

WARNING

Risk of injury! Do not use in areas with high magnetic fields.

The IQAN-LC5-X05 is based on hall effect sensors. Exposure to high external magnetic fields may lead to unwanted activation of the output signals.

For maximum allowed external magnetic field, see Appendix A, on page 21.

5 Mounting

Mounting the unit

NOTICE
The IQAN-LC5-X05 unit should be mounted according to the following instructions.

Mounting considerations

- The control lever must be built in so that it is protected against direct pressurized liquid spray (above flange) and excessive mechanical forces.
- 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.

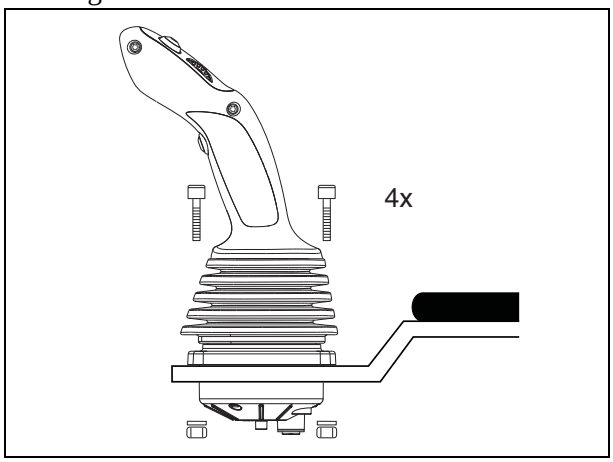
- Mount the unit so that it is not exposed to external heat, e.g. from the engine or heater.
- Mount the unit so there is no risk that the harness can be folded, crushed, worn or damaged in any way.
- Locate the harness so there is no pressure on the connector.
- Use ergonomics. The control lever should be mounted at a height so that there is no pressure on the driver's arm and shoulders. The IQAN-LC5-X05 and a well designed handle, such as the MP, combined with moveable arm rests, can provide good ergonomics.

NOTICE
Do not exceed power supply limits for the joystick base and thumbwheel.

Reversed polarity, or supply voltage different from recommended operating conditions, see Appendix A, on page 21, will seriously damage the unit.

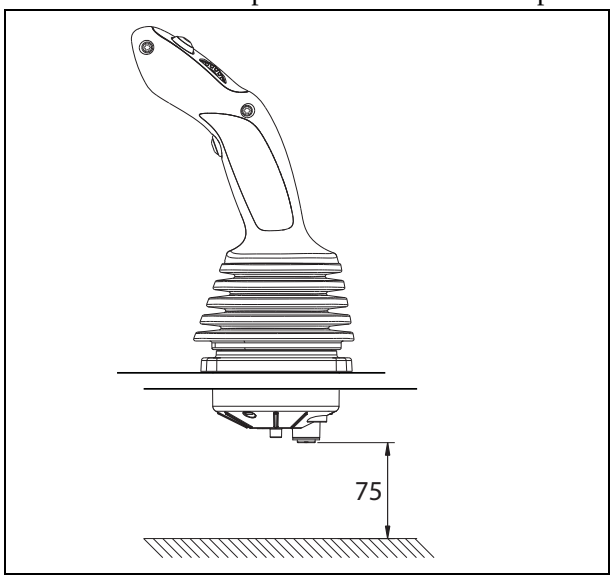
Mounting methods

- Control lever IQAN-LC5-X05 must only be mounted using screws through the flange.



Mounting the IQAN-LC5-X05 with screws.

- Allow sufficient space beneath the unit to provide for unplugging the connector.



Required space for connector.

Please refer to the IQAN-LC5-X05 installation sheet for mounting dimensions.

Handle considerations

Recommended handle specification

In addition to the MP handle, the IQAN-LC5-X05 will accept OEM specified handles. These handles will need to be adapted to mount on the joystick stem. The maximum weight of any handle fitted to the IQAN-LC5-X05 combined with its center of gravity (COG), shall not cause more force than the minimum activation moment. For the minimum activation force, see Appendix A, on page 29. Any tilting of the lever by armrest movement or possible machine leveling or orientation should be taken into consideration when specifying a suitable handle.

WARNING

Risk of injury! Exceeding the recommended handle specifications could cause unintended movement of the joystick.

Environmental specification

Any handle used with the IQAN-LC5-X05 should be a sealed type that is rated IP65 for outdoor use. Additionally, the joystick must always have a bellow installed to ensure that it will meet the environmental specification for sealing above the flange. When using a handle from a different manufacturer than Parker, be sure to include a suitable bellow made of a material that is able to withstand the stresses of outdoor use in mobile hydraulic machinery.

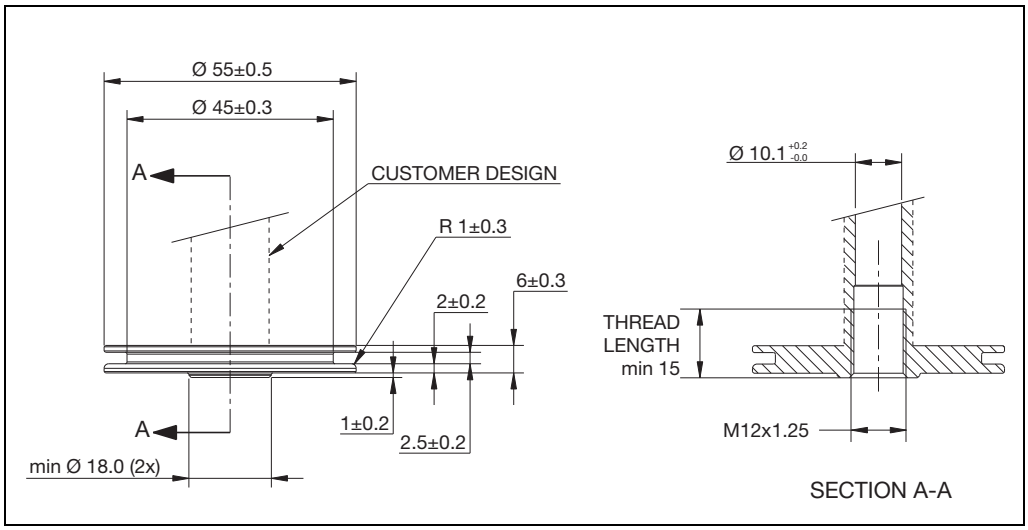
NOTICE

Failure to use a properly fitted bellow of the correct material will cause the unit to not meet its environmental specification and may result in damage to the IQAN-LC5-X05 joystick.

Handle configuration to fit -U2 bellow

The IQAN-LC5-X05 is offered without a handle, either no bellow (-U1) is supplied, or a standard bellow with Ø40mm opening is supplied (-U2). A handle of customer design or from a 3rd party handle manufacturer may use this standard boot if the mounting bushing is properly designed.

The LC5 handle mount consists of a Ø10mm stem and M12 thread, for dimensions, see section Dimensioning of the IQAN-LC5-X05, on page 24. To fit the -U2 bellow, a disc with a groove to hold the top of the bellow needs to be an integral part of the handle mount.



Disc dimension guidelines for -U2 bellow interface.

Depending on the mount design, the disc may be plastic if desired, however, the threaded part of the handle mount that is tightened to the LC5 stem should be metal for strength.

NOTICE

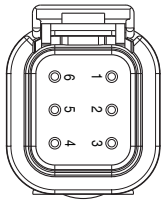
The design shown above is a guideline only!

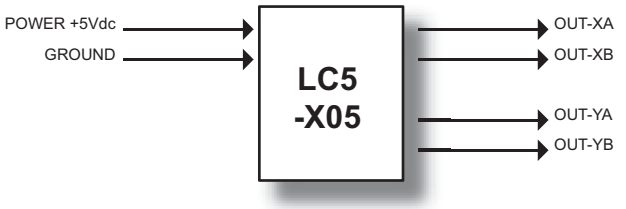
The customer is responsible for developing a suitable handle interface when mounting a non-Parker handle to an IQAN-LC5-X05-U2 joystick base.

6 Installation

IQAN-LC5-X05 connector C1

Connector kit	**Parker 20072408**	
Housing	Deutsch no. DTM06-6S	**C1**
Pin type	Deutsch no. 1062-20-0222	
Wedge type	Deutsch no. WM6S	
Sealing plug	Deutsch no. 0413-204-2005	
Recommended cable	0.75-1 mm^2 (18 AWG)	





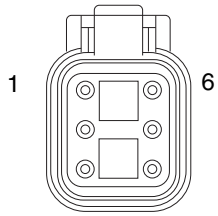
Connector C1 pin assignments

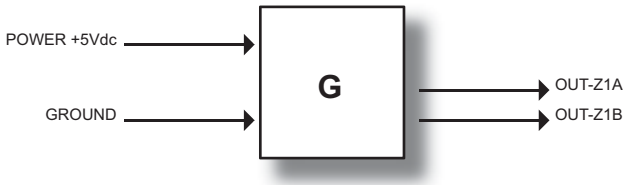
Symbol	Pin No.	Function
Power	6	Power supply Vs, +5Vdc
GND	1	Power supply ground, 0Vdc
OUT-XA	2	X primary signal, 10%-90% Vs
OUT-XB	5	X secondary signal, 90%-10% Vs
OUT-YA	3	Y primary signal, 10%-90% Vs
OUT-YB	4	Y secondary signal, 90%-10% Vs

G handle connector, 6 position

Connector parts	**Parker 5035017**
Housing	Deutsch no. DTM04-6P
Pin type	Deutsch no. 1060-20-0222
Wedge type	Deutsch no. WM6P
Sealing plug	Deutsch no. 0413-204-2005
Supplied on handle type	G

C1

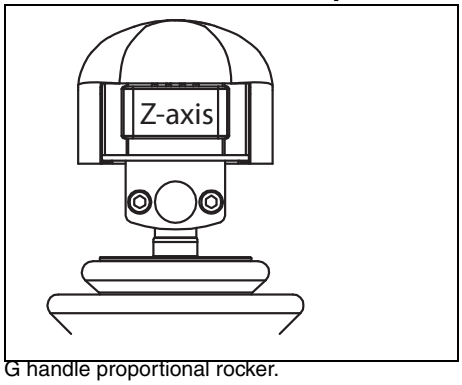




Connector, 6 position assignments

		G handle
Symbol	**Color**	**Pin No.**
-Vref-B	Black	1
OUT-ZA	White	2
OUT-ZB	Green	3
-	-	
-	-	
+Vref-B	Red	6

G handle function for 6 position connector

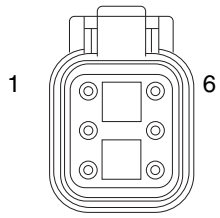


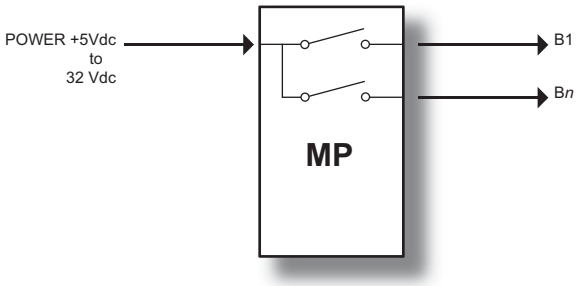
G handle proportional rocker.

MP handle connector, 6 position

Connector parts	**Parker 5035017**
Housing	Deutsch no. DTM04-6P
Pin type	Deutsch no. 1060-20-0222
Wedge type	Deutsch no. WM6P
Sealing plug	Deutsch no. 0413-204-2005
Supplied on handle types	MPB0W0T1, MPB2W0T0, MPB2W0T1, MPB4W0T0

C1

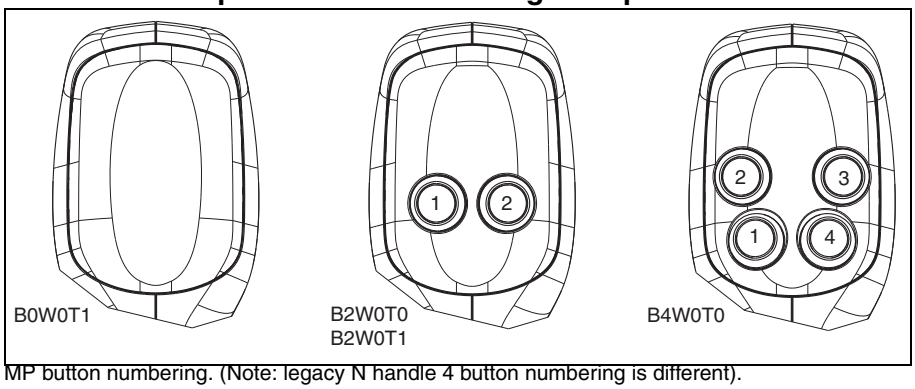




Connector, 6 position assignments

		MPB0W0T1	**MPB2W0T0**	**MPB2W0T1**	**MPB4W0T0**
Symbol	**Color**	**Pin No.**	**Pin No.**	**Pin No.**	**Pin No.**
+Vref-B	Red	6	6	6	6
B1	Grey		2	2	2
B2	Green		3	3	3
B3	Brown				4
B4	Violet				5
T1	Pink	4		4	

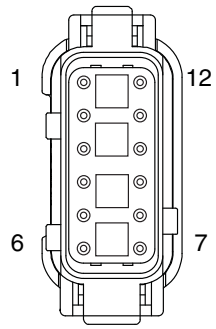
MP handle faceplate button numbering for 6 position



MP button numbering. (Note: legacy N handle 4 button numbering is different).

MP handle connector, 12 position

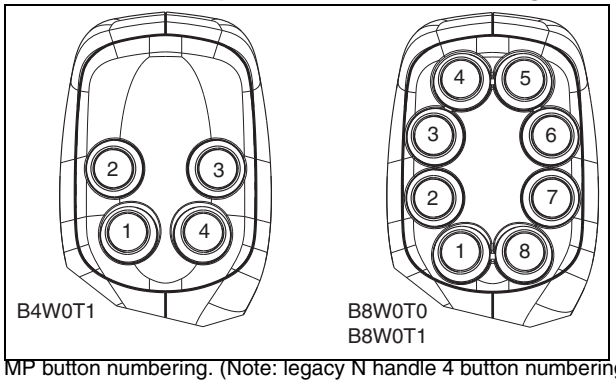
Connector parts	**Parker 5035018**
Housing	Deutsch no. DTM04-12PA
Pin type	Deutsch no. 1060-20-0222
Wedge type	Deutsch no. WM12P
Sealing plug	Deutsch no. 0413-204-2005
Supplied on handle types	MPB4W0T1, MPB8W0T0, MPB8W0T1, MPB2W2T0, MPB2W2T1, MPB4W1T0, MPB4W1T1



Connector, 12 position assignments

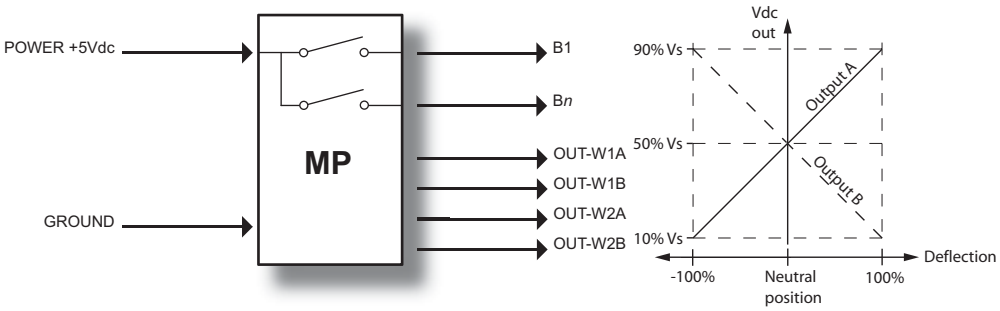
		MPB4W0T1	**MPB8W0T0**	**MPB8W0T1**
Symbol	**Color**	**Pin No.**	**Pin No.**	**Pin No.**
+Vref-A	Red	12	12	12
B1	Grey	4	4	4
B2	Green	5	5	5
B3	Brown	6	6	6
B4	Violet	8	8	8
B5	Yellow		2	2
B6	Orange		3	3
B7	White		10	10
B8	Blue		11	11
T1	Pink	9		9

MP handle faceplate button numbering for 12 position



MP button numbering. (Note: legacy N handle 4 button numbering is different).

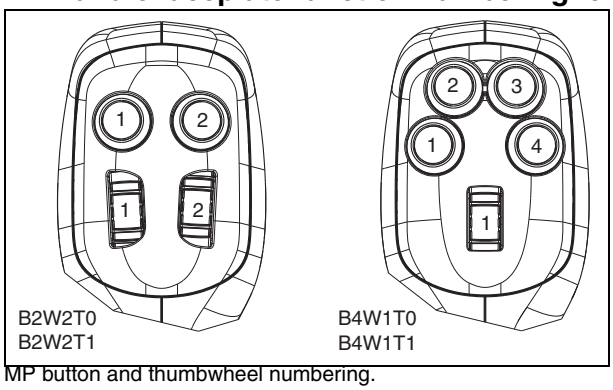
Types with thumbwheels continued in separate table.



Connector, 12 position assignments

		MPB2W2T0	MPB2W2T1	MPB4W1T0	MPB4W1T1
Symbol	**Colour**	**Pin No.**	**Pin No.**	**Pin No.**	**Pin No.**
+Vref-A	Red	12	12	12	12
-Vref-A	Black	1	1	1	1
B1	Grey	4	4	4	4
B2	Green	5	5	5	5
B3	Brown			6	6
B4	Violet			8	8
T1	Pink		9		9
OUT-W1P	Yellow	2	2	2	2
OUT-W1S	Orange	3	3	3	3
OUT-W2P	White	10	10		
OUT-W2S	Blue	11	11		

MP handle faceplate function numbering for 12 position



MP button and thumbwheel numbering.

Required connectors, based on model code

Model code	20072408	5035017	5035018
IQAN-LC5-X05-U1	X	-	-
IQAN-LC5-X05-U2	X	-	-
IQAN-LC5-X05-G	X	X	
IQAN-LC5-X05-MPB0W0T0	X	-	-
IQAN-LC5-X05-MPB0W0T1	X	X	-
IQAN-LC5-X05-MPB2W0T0	X	X	-
IQAN-LC5-X05-MPB2W0T1	X	X	-
IQAN-LC5-X05-MPB4W0T0	X	X	-
IQAN-LC5-X05-MPB4W0T1	X	-	X
IQAN-LC5-X05-MPB8W0T0	X	-	X
IQAN-LC5-X05-MPB8W0T1	X	-	X
IQAN-LC5-X05-MPB4W1T0	X	-	X
IQAN-LC5-X05-MPB4W1T1	X	-	X
IQAN-LC5-X05-MPB2W2T0	X	-	X
IQAN-LC5-X05-MPB2W2T1	X	-	X

Supply voltage

WARNING

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

Emergency stop

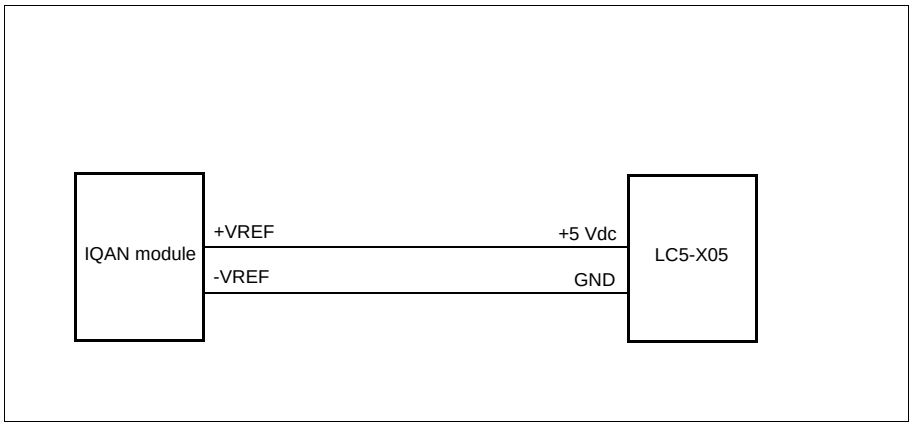
Make sure an *Emergency Stop* disconnecting the system power supply, is easily accessible at any time. The IQAN module and standalone controller instruction books show how to connect an emergency stop.

Connecting of supply voltage, expansion module

The supply voltage, should be within the operating range, see Appendix A, on page 21.

Connect the supply voltage to POWER +5Vdc, pin C1:6. The regulated 5Vdc is supplied from an IQAN module's +VREF. The ground connection is made from GND pin C1:1 to the IQAN module's -VREF.

EXAMPLE



Connecting an IQAN-LC5-X05 to expansion module.

NOTICE

Maximum load for the *VREF* position is different between types of IQAN modules. Refer to the appropriate instruction book.

Output signals

Primary and secondary outputs

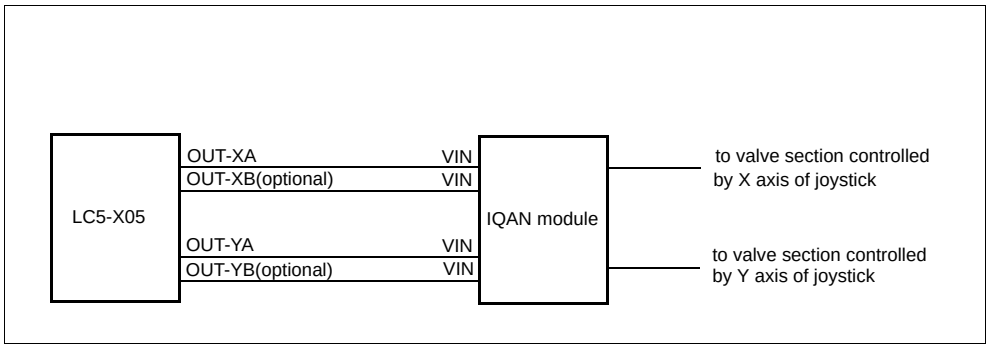
The IQAN-LC5-X05 has dual outputs for each axis. The redundant outputs allow the user to set up controller logic that monitors the integrity of the dual joystick signals. The secondary signal for each axis is a mirror of the primary signal. Use of the secondary output is optional and determined by the user's requirements.

Connecting of IQAN-LC5-X05 outputs

When you connect the IQAN-LC5-X05 joystick to a module or standalone controller, you may use both OUT-[axis]A and OUT-[axis]B signals from the joystick. The primary signal for the axis is connected to a VIN, *voltage input* and the secondary signal for the axis, if used, is connected to a separate VIN on the controller module.

Connect each primary axis 10%-90% Vs output signal to VIN, and optionally connect the corresponding secondary axis 90%-10% Vs output signal to another VIN.

EXAMPLE



Connecting an IQAN-LC5-X05 to a module.

WARNING

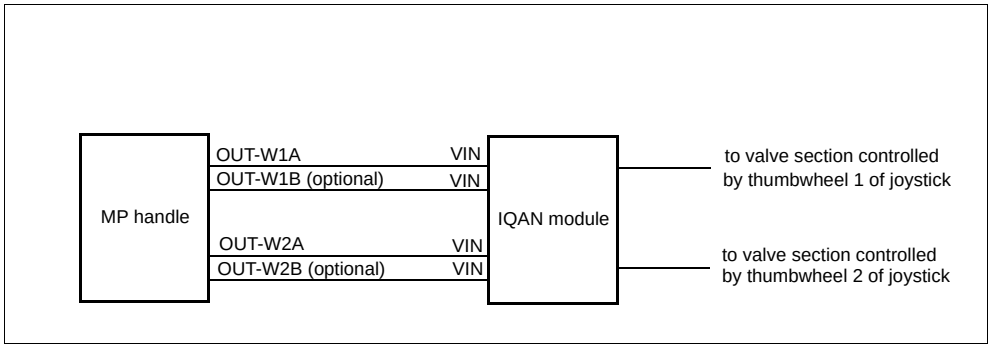
The previous example is presented with limited information to explain the use of primary and secondary signals from the IQAN-LC5-X05. Safety considerations such as the use of an 'operator present' switch to enable outputs etc. are always recommended.

Connecting of -MP handle outputs

When you connect the IQAN-LC5-X05 joystick handle functions to a module or standalone controller you may have proportional outputs from thumbwheels, or on-off outputs from buttons. For the proportional outputs, you may use both OUT-A and OUT-B signals from the thumbwheels. The primary signal for the axis is connected to a VIN, *voltage input* and the secondary signal for the axis, if used, is connected to a separate VIN on the controller module.

Connect each primary output 10%-90% Vs output signal to VIN, and optionally connect the corresponding secondary output 90%-10% Vs output signal to another VIN.

EXAMPLE



Connecting -MP thumbwheel outputs to a module.

WARNING

The previous example is presented with limited information to explain the use of primary and secondary signals from the -MP handle thumbwheels. Safety considerations such as the use of an 'operator present' switch to enable outputs etc. are always recommended.

Appendix A

IQAN-LC5-X05 Technical Overview

IQAN-LC5-X05, base and -MP handle

Absolute Maximum Ratings[a]

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Ambient temperature, T_A Storage temperature	– 40 – 40		+85 +100	°C	
Maximum over voltage on any pin			8.5	V	
External magnetic fields			2.5	mT	Risk for exceeding maximum difference on output signal from ideal value.

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	Remark
EMI	
ISO 13766/ISO 14982, radiated emission	30 - 1000 MHz
ISO 11452-4:2005, conducted susceptability	1 -200 MHz, 1 KHz, 80%AM, 100 mA
ISO 11452-2:2004, radiated susceptability	200 -2000 MHz, 1 KHz, 80%AM, 100 V/m
ISO 7637-3:2007, conducted transients susceptability	Level 3
ESD	
ISO 10605:2001, ESD, operation	15kV air
ISO 10605:2001, ESD, operation	8 kV contact
ISO 10605:2001, ESD, handling	4 kV contact
Mechanical environment	
IEC 60068-2-64:1993 Fh, random vibration	15-1000 Hz, 11.6 grms, 3 x10 hours
IEC 60068-2-29:1987 Eb, bump	40g, 6 ms, 1000 x 6 directions
Climate environment	
IEC 600529:2001 IP65, (with sealed handle and bellow)	12.5 l/minute, 3 minutes
IEC 60068-2-52:1996 Kb, salt mist	72 hours
IEC 60068-2-30:1985 Db, damp heat, cyclic	+55°C, 95% RH, 6 cycles
IEC 60068-2-78:2001, damp heat, steady state	+40°C, 93% RH, 21 days
IEC 60068-2-2:1993-01 Bb, heat, operation	+70°C, 72 hours
IEC 60068-2-2:1993-01 Bb, heat, storage	+100°C, 72 hours
IEC 60068-2-1:1993-02 Ab, cold	-40°C, 16 hours
IEC 60068-2-14:1984 Nb, change of temperature	-30°C to +85°C, 100 x 4 hours

System

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

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Weight, base unit Weight, base unit + MP handle		380 750		g	
Ambient temperature, T_{ROC}	– 40		+85	°C	recommended operating
Voltage supply, V_S	4.5	5.0	5.5	V	
Current consumption, base only		33	46	mA	V_S = 5.0 V

IQAN-LC5-X05, base

Electrical characteristics

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Number of VOUT		4			antivalent signals
VOUT, minimum position	400	500	600	mV	over life of unit
VOUT, center position	2400	2500	2600	mV	over life of unit
VOUT, maximum position	4400	4500	4600	mV	over life of unit
VOUT linearity error			300	mV	Max difference on output signal A or B from ideal
VOUT A and B difference			375	mV	Max difference between output signals A/B
VOUT resolution		12		bits	=1.22 mV
Response time		6		ms	
Load, resistive	4.5			kohm	
Load, capacitive			1	µF	
Continuous voltage			5.5	V	
Protection		SCG			

Mechanical ratings

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Angle of movement		±18		deg.	
Deflection moment, neutral		0.6		Nm	
Deflection moment, fully actuated		1.4		Nm	
One time loading			100	Nm	Exceptional condition
Expected life		$5x10^6$		cycles	One cycle: Neutral to full + direction to neutral to full - direction and back to neutral

IQAN-LC5-X05, -MP handle

Thumbwheel

Electrical characteristics

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Number of VOUT		2			antivalent signals
VOUT minimum position	400	500	600	V	V_S = 5.0 V
VOUT center position	2400	2500	2600	V	V_S = 5.0 V
VOUT maximum position	4400	4500	4600	V	V_S = 5.0 V
VOUT linearity error			300	mV	Max difference on output signal A or B from ideal
VOUT A and B difference			375	mV	Max difference between output signal A/B
VOUT resolution		12		bits	=1.22 mV
Response time		6		ms	
Load, resistive	4.5			kohm	
Load, capacitive			1	µF	
Continuous voltage			5.5	V	
Current supply, per thumbwheel		16	23	mA	Vs=5,0V,
Protection		SCG			

Mechanical ratings

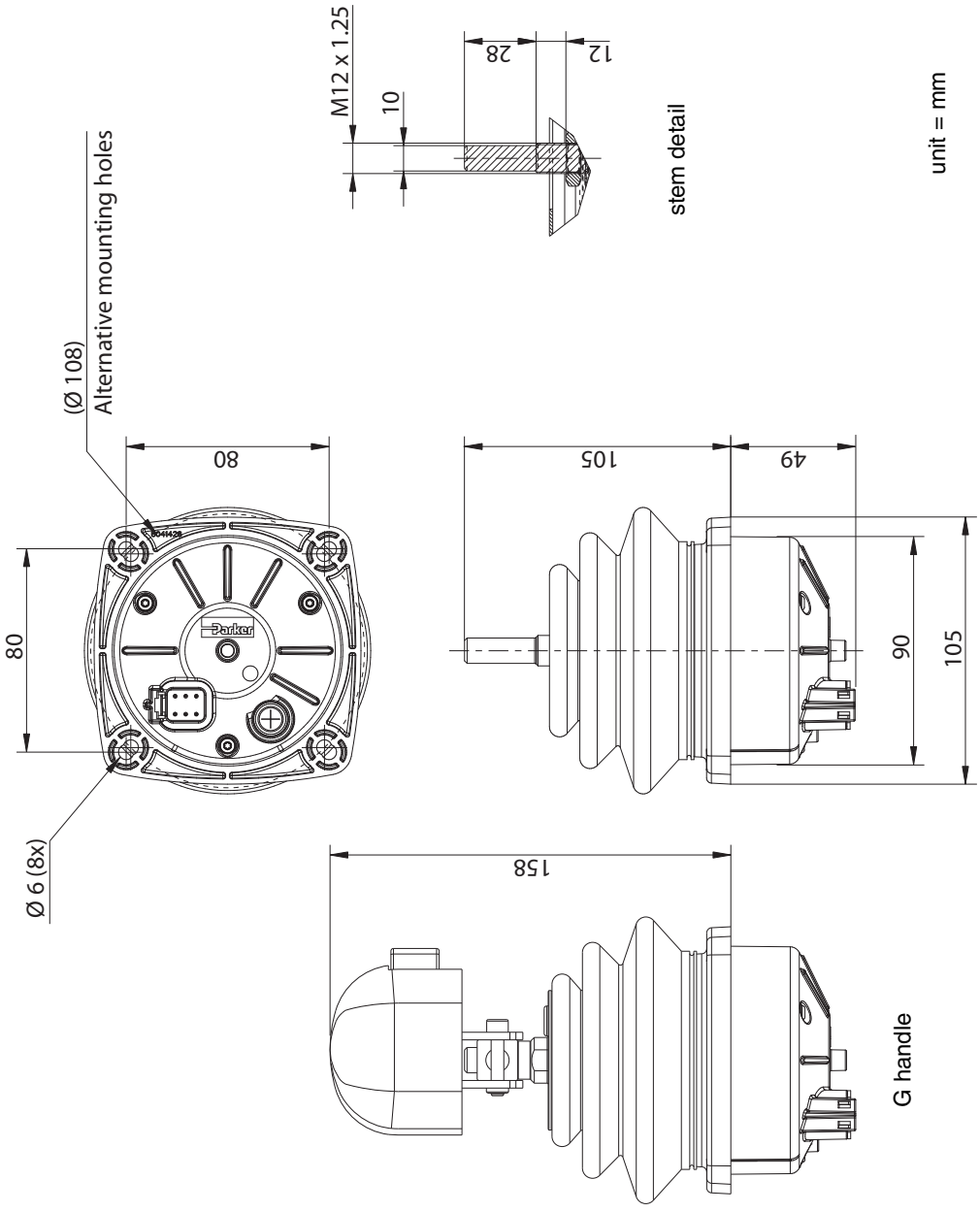
Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Angle of movement		±25		deg.	
Deflection moment, neutral		10		Nmm	
Deflection moment, fully actuated		15		Nmm	
Expected life		$5x10^6$		cycles	One cycle: Neutral to full + direction to neutral to full - direction and back to neutral

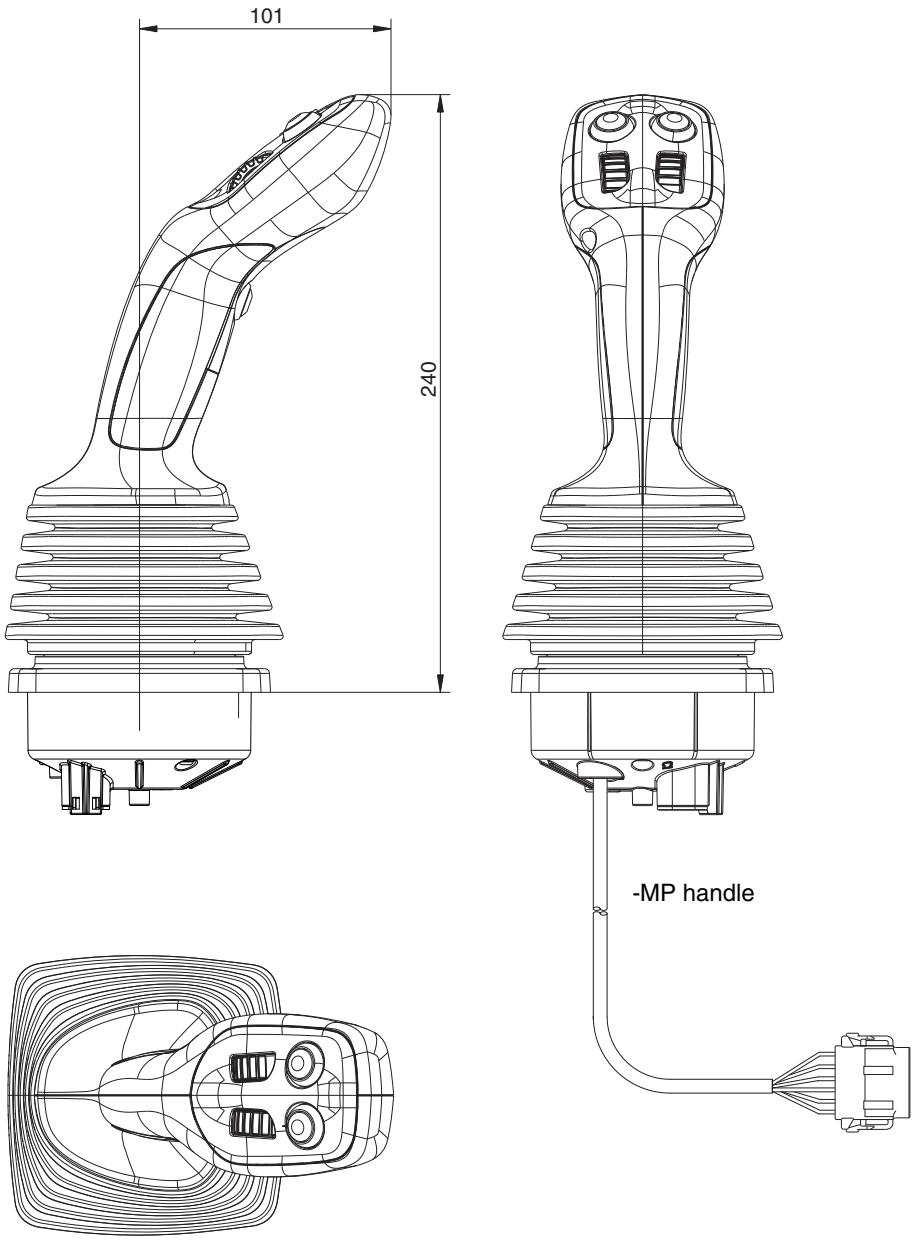
Buttons

Parameter	Limit values			Unit	Remark
	min.	typ.	max.		
Max current			400 100	mA	32 VAC, resistive load 50 VDC, resistive load
Total travel		1.5		mm	
Switching point		1.2		mm	
Expected life		$.5x10^6$		cycles	electrical
Mechanical life		$1x10^6$		cycles	
Operating force	2		5	N	activation

Appendix B

Dimensioning of the IQAN-LC5-X05





unit = mm

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Publ no HY33-8402-IB/UK
Edition 2016-08-09

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