PHC

DIGITAL ELECTRONIC SYSTEMS

DRC remote control systems

walvoil
HYDRAULIC CONTROL SYSTEMS

valvoilgroup

Additional information

This catalogue shows the product in the most standard configurations.
Please contact Sales Dpt. for more detailed information or special request.

WARNING!

All specifications of this catalogue refer to the standard product at this date. Walvoil, oriented to a continuous improvement, reserves the right to discontinue, modify or revise the specifications, without notice.

WALVOIL IS NOT RESPONSIBLE FOR ANY DAMAGE CAUSED BY AN INCORRECT USE OF THE PRODUCT.

2nd edition January 2007:
This edition supercedes all prior documents.

Content

System description

Introduction

The PHC components are born out the projects co-developed with the largest mobile machines OEMs .
This extensive experience is now available to all Walvoil customers and Master Distributors.

- **Field proven hardware**

The PHC components have demonstrated their reliability in thousands of installations on off-highway machines for agriculture, earth moving and building construction.
Those very same components are now available as off-the-shelf products for low to mid volume productions.

- **Standard software**: no hidden development and validation costs

The PHC system performs just one specific function: the electronic remote control of electro-hydraulic valves.
The Human Machine Interface can be fully customized (with different joysticks, hand grips and potentiometers)
The installation and calibration are very easy (only min and max speed for each movement need to be set).

- **Future proof technology**

Compact and reliable, the PHC system has been expressely designed for use in off-highway machines and is built along the technical requirements of the major global OEMs.
The specifications for operating temperature, vibrations, water protection and EMC come directly from "our" world, the world of mobile off-highway machines.

- **Complete control solution**

The PHC systems can be supplied together with dedicated wire harnesses and connector kits.
All the necessary installation and calibration tools are already available (from crimping tools to WST calibration software).

- **Ready to start**

Right out of the box the PHC systems are ready to be put into operation.
The final adjustment is done with a personal computer and the WST calibration and diagnostic software.

Working principle

The PHC system works according to the well known principle of remote control with proportional pressure reducing valves.
The operator sets the operating speed with the joystick, the electronic control unit CED converts this set point into a regulated PWM current and the valve electro-hydraulic control kit drives the spool to the requested position.
The joystick communicates with the control unit by mean of a voltage signal (absolute or ratiometric).
All the CED control units in the PHC system are also ready for CAN Bus communication.

How to choose

Just answer 3 easy questions:

1. How many proportional functions?

The right control unit at the right cost: CED110, 251 or 252 for 1,2 or 3 proportional functions.

2. What input device?

The operator comfort and productivity depend heavily on the number, shape and position of the input devices.
PHC joysticks are available in two different technologies: ”Potentiometer based, Ratiometric voltage” (Family P) and ”Contactless, Absolute voltage ” (Family F).
In the two families there are complete joysticks, with different ergonomics and dimensions, and hand grips for the SWM hydraulic joysticks or LCB mechanical joysticks. This makes easy to add electrical auxiliary functions to manually or hydraulically operated valves (third and fourth functions).
The main features of P and F input devices are listed below:

Family P

Benefits:

- simple reliable construction (potentiometer)
- different shapes readily available

Disadvantages:

- limited electrical life (resistive track wear)

Family F

Benefits:

- contactless technology (e.g. Hall effect)
- long electrical life

Disadvantages:

- more sensitive to ESD and over-voltages

3. Which directional valve?

In order to get the best performance in terms of hysteresis and response time each valve type is driven with the most suitable control algorithm.

System description

Description example for complete system:

PHC100P / MDN..... + KCD..... + CED.....

1. 2. 3.

1. Input devices

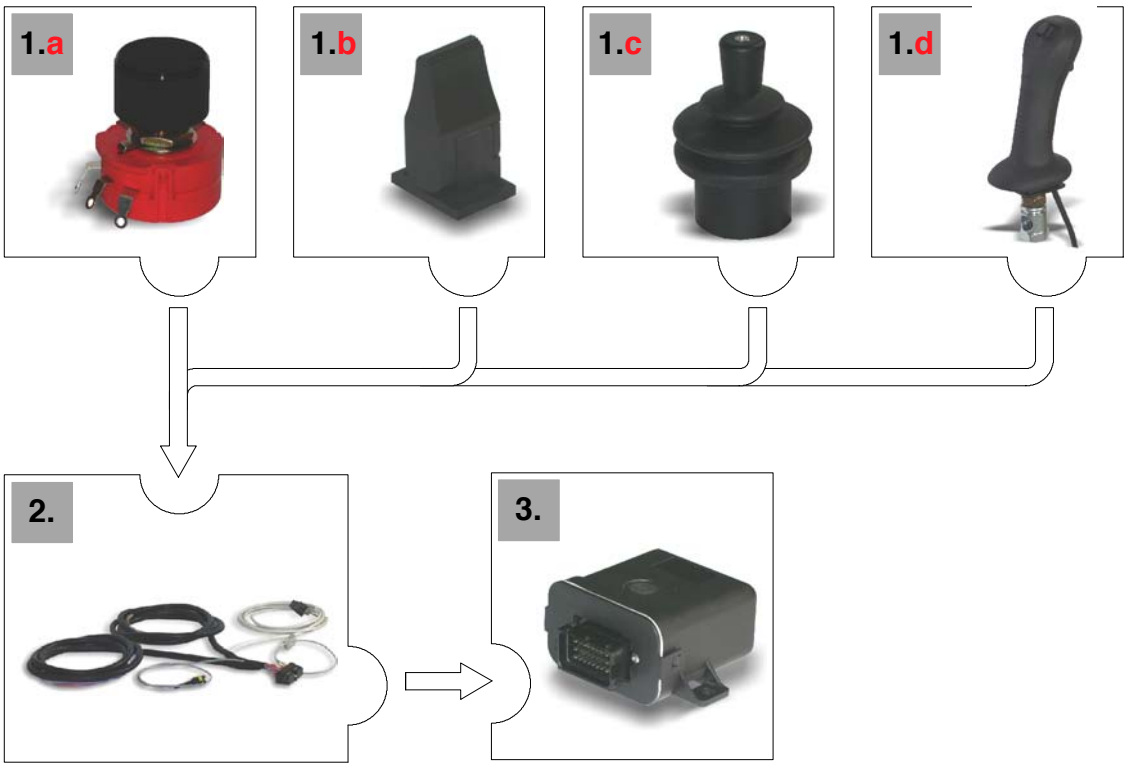
REF: **a** . . . . . *page 13*
TYPE: **PTM101**
CODE: **5POT100003**
DESCRIPTION: One-way rotative potentiometer
REF: **b** . . . . . *page 15*
TYPE: **MDN142**
CODE: **VJOY200001**
DESCRIPTION: Single axis proportional joystick with fingertips control
REF: **c** . . . . . *page 18*
TYPE: **MDN131**
CODE: **VJOY200002**
DESCRIPTION: Single axis proportional joystick
REF: **d** . . . . . *page 21*
TYPE: **S119-049**
CODE: **2IM5110003** - *code is referred to handle standard configuration, for options see page 23.*
DESCRIPTION: Series S potentiometric handle with front push-button, with assembling joint for SVM400 pilot control valve.

2. Harness unit *page 62*

TYPE: **KCDP04/CSIF24-01O2300(TC)-03O2300(TC)-09A1M03100 (TAP)-AU1F05400**
CODE: **183480060**
DESCRIPTION: Harness for PHC100P system wiring

3. Control unit *page 51*

TYPE: **CED110/WALVOIL/PHC100P/v100.01**
CODE: **183310011**
DESCRIPTION: For PHC100P system



Description example for complete system:

PHC100F / MDT..... + KCD..... + CED.....

1. 2. 3.

1. Input devices *

REFERENCE: **a** . . . . . *page 24*
TYPE: **AL40-HZA0-ZG1035(D2F04)-0RD035(D2F02)-M12x250**
CODE: **170400276**
DESCRIPTION: Series HZ handle, proportional rocker, “dead man” switch and Deutsch DTM connectors, with M12x250 rod for assembling on LCB mechanical joystick.
REFERENCE: **b** . . . . . *page 28*
TYPE: **MDT119HA00C-0RD/01D2F04030-02D2F02030+CAVO ESD L=1.5**
CODE: **183520088**
DESCRIPTION: Single axis joystick with Series H handle, “dead man” switch and Deutsch DTM connectors

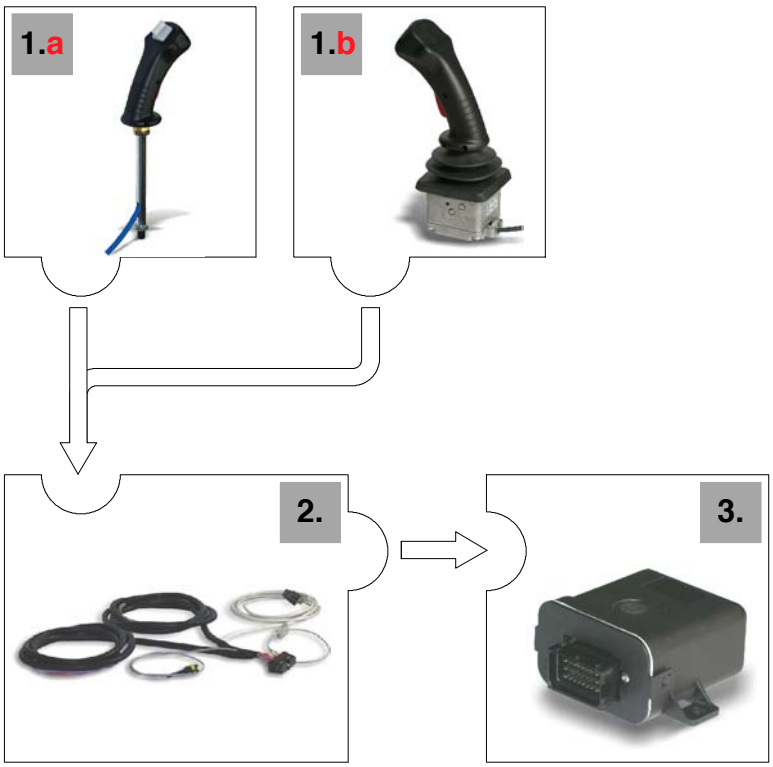
NOTE (*) - *Codes are referred to input devices standard configurations; for options see pages related to sigle control.*

2. Harness unit *page 64*

TYPE: **KCDF05/CSIF24-01D2M04300(TC)-02D2M02300(TC)-03O2300-09A1M03100(TAP)-AU1F05400**
CODE: **183480061**
DESCRIPTION: Harness for PHC100F system wiring with Deutsch DTM connectors

3. Control unit *page 51*

TYPE: **CED110/WALVOIL/PHC100F/v100.00**
CODE: **183310010**
DESCRIPTION: For PHC100F system



System description

Description example for complete system:

PHC200P / MDN..... + KCD..... + CED.....

1. 2. 3.

1. Input devices

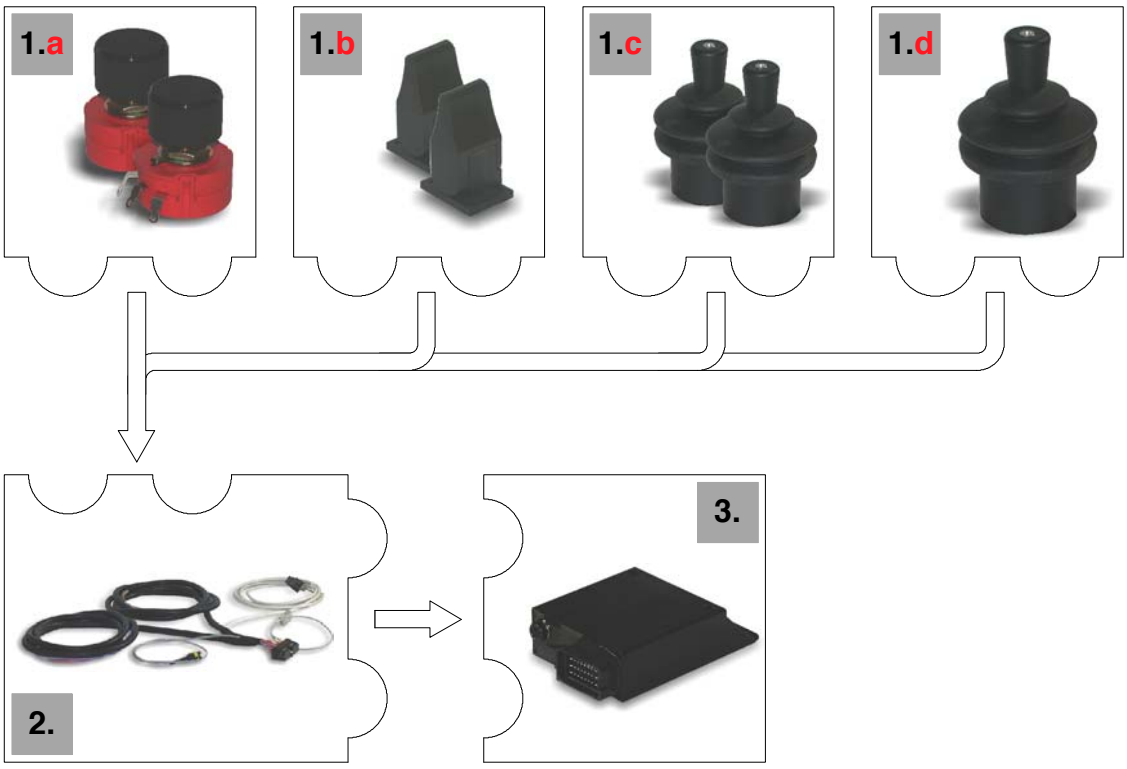
REF: **a** . . . . . *page 13*
TYPE: **PTM101**
CODE: **5POT100003**
DESCRIPTION: One-way rotative potentiometer: n.2 devices are required
REF: **b** . . . . . *page 15*
TYPE: **MDN142**
CODE: **VJOY200001**
DESCRIPTION: Single axis proportional joystick with fingertips control: n.2 devices are required
RIF: **c** . . . . . *page 18*
TIPO: **MDN131**
CODE: **VJOY200002**
DESCRIPTION: Single axis proportional joystick: n.2 devices are required
REF: **d** . . . . . *page 32*
TYPE: **MDN231**
CODE: **VJOY200003**
DESCRIPTION: Two axis proportional joystick

2. Harness unit *page 66*

TYPE: **KCDP03/CSIF24-01O2300(TC)-03O2300(TC)-AU1F05400**
CODE: **183480062**
DESCRIPTION: Harness for PHC200P system wiring

3. Control unit *page 54*

TYPE: **CED251/WALVOIL/PHC200P/v200.01**
CODE: **183340015**
DESCRPTION: For PHC200P system



Description example for complete system:

PHC200F / MDT..... + KCD..... + CED.....

1. 2. 3.

1. Input devices *

REFERENCE: **a** . . . . . *page 35*
TYPE: **AL80PZA0200A0-0RD035(D2F02)-XG3035(U)-YG3035 (D2F06)-M12x280**
CODE: **170800012**
DESCRIPTION: M12x280 handlever with Series PZ handle, two proportional rocker, “dead man” switch and Deutsch DTM connectors, with M12x280 rod for assembling on LCB mechanical joystick.
REFERENCE: **b** . . . . . *page 39*
TYPE: **MDT219HA00C-0RD/01D2F06030-02D2F02030+CAVO ESD L=1.5**
CODE: **183520085**
DESCRIPTION: Two axis joystick with Series H handle, “dead man” switch and Deutsch DTM connectors.

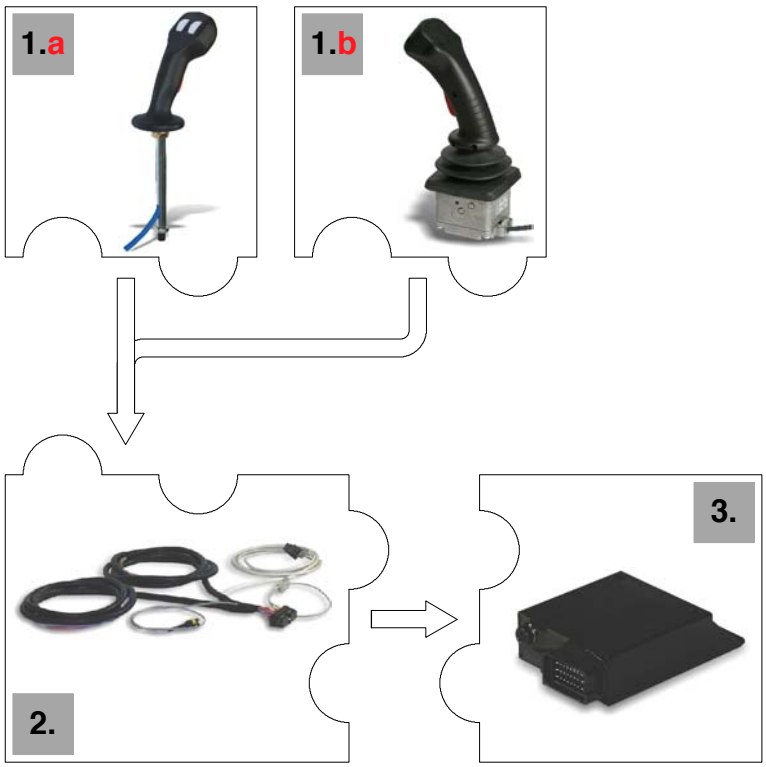
NOTE (*) - *Codes are referred to input devices standard configurations; for options see pages related to sigle control.*

2. Harness unit *page 68*

TYPE: **KCDF04/CSIF24-01D2M06300(TC)-02D2M02300(TC)-03O2300(TC)-AU1F05400**
CODE: **183480063**
DESCRIPTION: Harness for PHC200F system wiring with Deutsch DTM connectors

3. Control unit *page 54*

TYPE: **CED251/WALVOIL/PHC200F/v200.00**
CODE: **183340016**
DESCRIPTION: For PHC200F system



System description

Description example for complete system:

PHC300P / MDN..... + KCD..... + CED.....

1. 2. 3.

1. Input devices

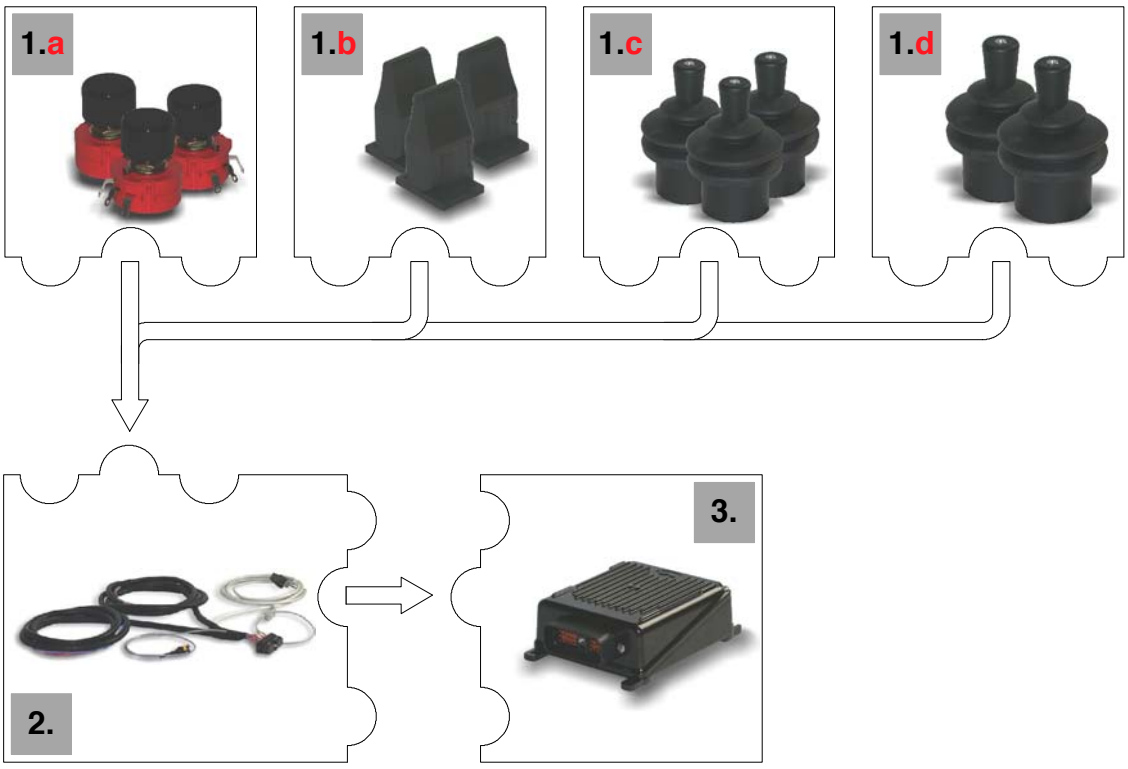
REF: **a** . . . . . *page 13*
TIPO: **PTM101**
CODE: **5POT100003**
DESCRIPTION: One-way rotative potentiometer: n.3 devices are required
REF: **b** . . . . . *page 15*
TYPE: **MDN142**
CODE: **VJOY200001**
DESCRIPTION: Single axis proportional joystick with fingertips control: n.3 devices are required
REF: **c** . . . . . *page 18*
TYPE: **MDN131**
CODE: **VJOY210002**
DESCRIPTION: Single axis proportional joystick: n.3 devices are required
REF: **d** . . . . . *pages 18+32*
TYPE: **MDN131+MDN231**
CODE: **VJOY210002+VJOY200003**
DESCRIPTION: Single axis proportional joystick + two axis proportional joystick

2. Harness unit *page 70*

TYPE:
KCDP04/CD3F40-01O2300(TC)-03O2300(TC)-09A1M03100(TAP)-AU1F05400
CODE: **183480064**
DESCRIPTION: Harness for PHC300P system wiring

3. Control unit *page 57*

TYPE: **CED252/WALVOIL/PHC300P/v300.01**
CODE: **183350002**
DESCRIPTION: For PHC300P system



Description example for complete system:

PHC300F / MDT..... + KCD..... + CED.....

1. 2. 3.

1. Input devices *

REFERENCE: **a** . . . . . *page 43*
TYPE: **MDT219HZAC-ZG1-0RD/01D2F08030-02D2F02030**
CODE: **183520090**
DESCRIPTION: Two axis joystick with Series HZ handle, proportional rocker, “dead man” switch and Deutsch DTM connectors
RIFERENCE: **b** . . . . . *page 47*
TYPE: **MDT219PZA0100AC-0RD-XG3/01D2F08030-02D2F02030 +CAVO ESD L=1.5**
CODE: **183520092**
DESCRIPTION: Two axis joystick with Series PZ handle, proportional rocker, “dead man” switch and Deutsch DTM connectors

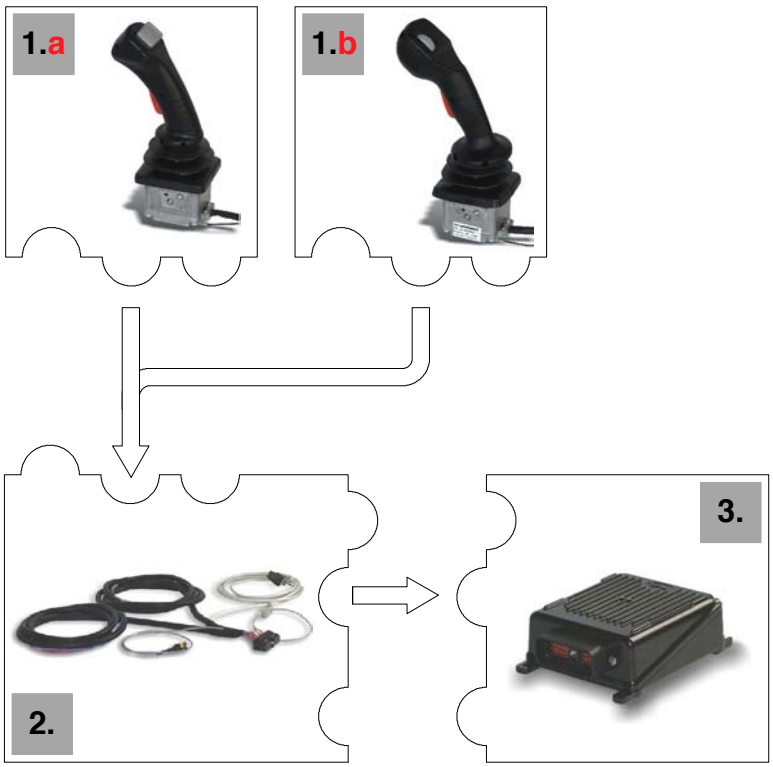
NOTE (*) - *Codes are referred to input devices standard configurations; for options see pages related to sigle control.*

2. Harness unit *page 72*

TYPE: **KCDF05/CD3F40-01D2M08300(TC)-02D2M02300(TC)-03O2300(TC)-AU1F05400**
CODE: **183480065**
DESCRIPTION: Harness for PHC300F system wiring with Deutsch DTM connectors

3. Control unit *page 57*

TYPE: **CED252/WALVOIL/PHC300F/v300.00**
CODE: **183350003**
DESCRIPTION: For PHC300F system



PTM101 rotative potentiometer

1 *proportional function*

Available for systems	
PHC100P■	PHC100F□
PHC200P■	PHC200F□
PHC300P■	PHC300F□

Description

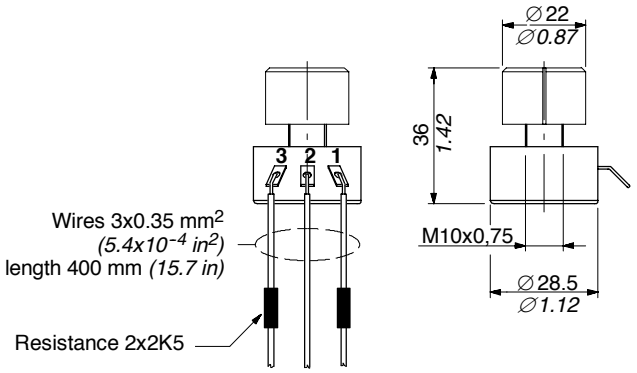
The PTM101 is a coal layer one-way rotative potentiometer for one proportional function control on a directional valve. Thanks to its small size, it can be placed inside portable unit.

Technical data

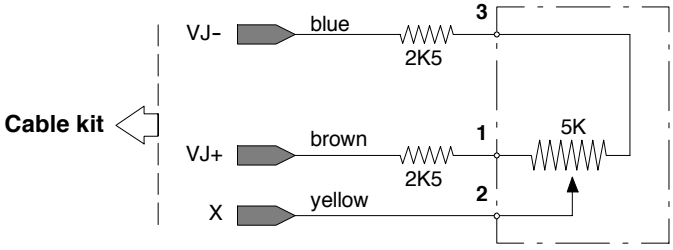
Resistance . . . . . : 5 Kohm ±20%
Max. power dissipation . . . . . : 0.4 W (@ 40°C)
Output signal (Vout/Vin%) . . . . . : from 25% to 75%
Working angle . . . . . : 300° ± 5°

PTM101 rotative potentiometer

Dimensions

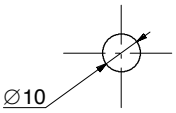


Electric circuit

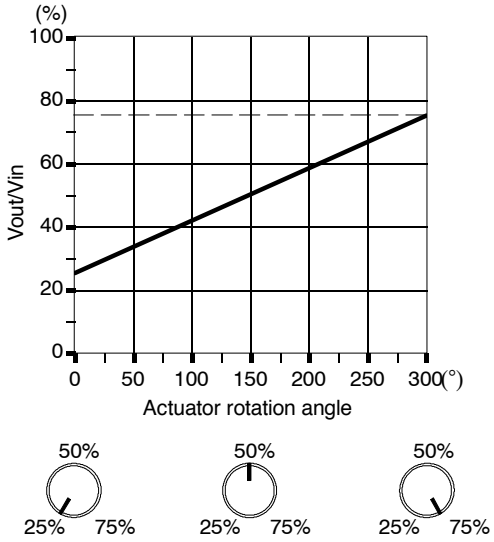


Pin	Wire colour	Description
1	brown	Supply + (VJ+)
2	yellow	Proportional signal (X)
3	blue	Supply - (VJ-)

Panel cut out



Output detail



MDN142 joystick

1 proportional function

Available for systems	
PHC100P■	PHC100F□
PHC200P■	PHC200F□
PHC300P■	PHC300F□

Description

Developed for applications where ergonomics and system integrity are paramount, the MDN142 is a compact, low profile joystick that provides precise fingertip control in one axis.

Thanks to reduced dimensions, the MDN142 is less susceptible to unintentional operation and its low operating force minimize repetitive stresses and operator fatigue.

With all of the components in the handle, it is ideal for mounting in low profile panels and arm rests.

Installation time has been reduced through the use of a standard electronic connector, whilst the absence of all micro switches and camshafts has eliminated the need to maintain the joystick throughout its operating life in excess of five million cycles.

MDN142 typical applications include remote control chest packs and the control of agricultural or material handling equipment.

Technical data

General

Max. supply voltage (Vin) . . . . . : 35VDC
Power absorption . . . . . : 0.25W (@ 25°C)
Lever deflection . . . . . : ±30°
Average lifetime (n^r of operation) . . : > 5x10^6
Working temperature . . . . . : from -25° C to +70° C
Protection degree (over fixing plan) . : IP66
Connector . . . . . : Dupont Dubox

Analog track

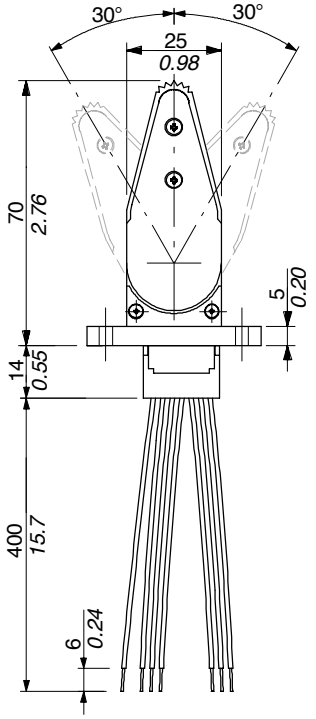
Total resistance . . . . . : 5kΩ ±20%
Output signal range (Vout/Vin%) . . . : from 25% to 75%
Central position signal (Vout/Vin%) . : 50%

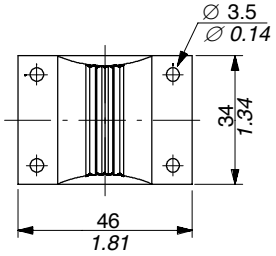
Directional and center off switch

Switch center gap . . . . . : 2.5° either directions
Max. load current . . . . . : 2mA

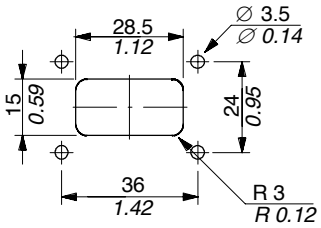
MDN142 joystick

Dimensions





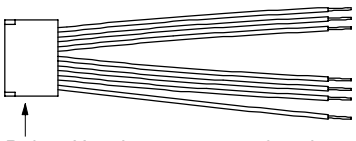
Panel cut out



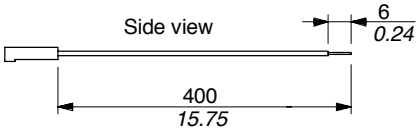
Connecting cable

Connecting cables are supplyed with the joystick, but they are also available as spare parts: they consisting of a female connector and 0.35 mm^2 (*5.4x10^{-4} in^2*) wires with tin-plate treminals.

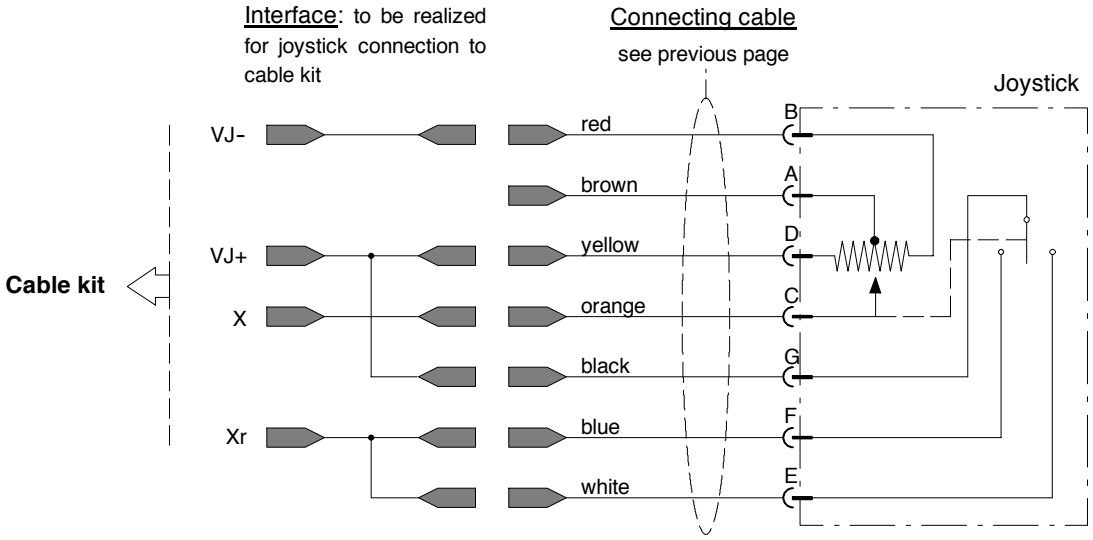
7 poles cable: code **W0450003**



Dubox Housing 65240-007 female connectors

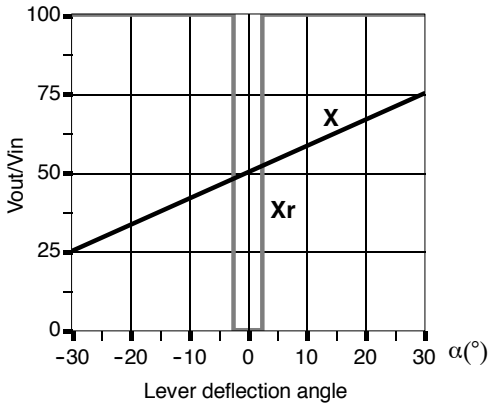


Electric circuit



Pin	Wire colour	Description
A	brown	Center proportional signal
B	yellow	Supply + (VJ+)
C	orange	Proportional signal (X)
D	red	Supply - (VJ-)
E	white	Signal redundancy - (Xr)
F	blue	Signal redundancy + (Xr)
G	black	Common microswitch

Output detail



MDN131 joystick

1 *proportional function*

Available for systems	
PHC100P■	PHC100F□
PHC200P■	PHC200F□
PHC300P■	PHC300F□

Description

The joystick MDN131 has been specifically designed to provide the control of one proportional function and meet the mobile machines today's market requirements.

Developed for applications where ergonomics and precise proportional control are required, the MDN131 is a low profile design joystick with fingetrip control; its low operating force minimize repetitive stresses and operator fatigue.

Compact dimensions makes it suitable for installation with reduced operation space as armrests and remote control chest packs.

In applications where operations assurance, wide lifetime and maintenance absence are decisive features, the MDN131 provides reliability and operating simplicity.

Technical data

General

Max. supply voltage (Vin) . . . . . : 35VDC
Power absoption . . . . . : 0.2W (@ 40°C)
Lever deflection . . . . . : ±20°
Average lifetime (n^r of operation) . . . : > 2.8 x10^6
Working temperature . . . . . : from -20° C to +70° C
Protection degree (over fixing plan) . : IP65
Connector . . . . . : Dupont Dubox

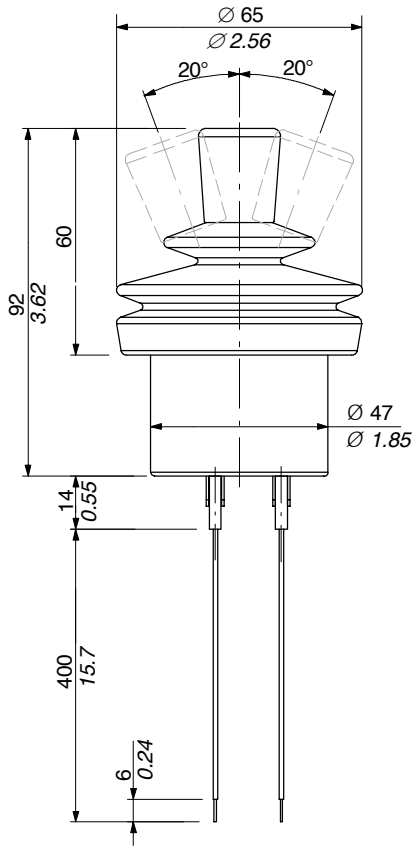
Analog track

Total resistance . . . . . : 5kΩ ±20%
Output signal range (Vout/Vin%) . . . : from 25% to 75%
Central position signal (Vout/Vin%) : 50%

Center off switch

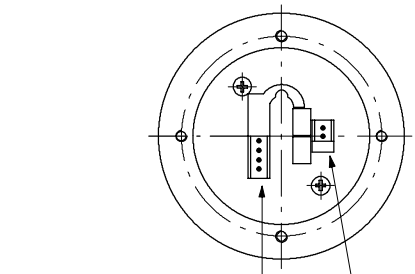
Switch center gap . . . . . : 5° either directions

Dimensions



Joystick bottom view

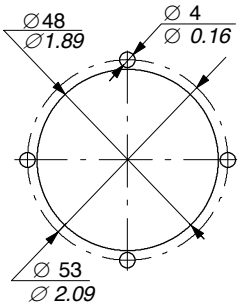
(cable less: for cable kit see next page)



Dubox Plug 76384-304
4 poles male connector

Dubox Plug 76384-302
2 poles male connector

Panel cut out

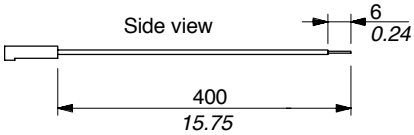


Connecting cables

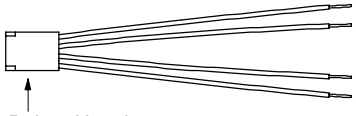
Connecting cables are supplyed with the joystick, but they are also available as spare parts: they consisting of a female connector and AWG24 wires with tin-plate treminals.

2 poles cable: code **W0450001**

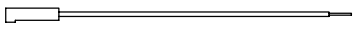
Dubox Housing 65240-002
female connector



4 poles cable: code **W0450002**

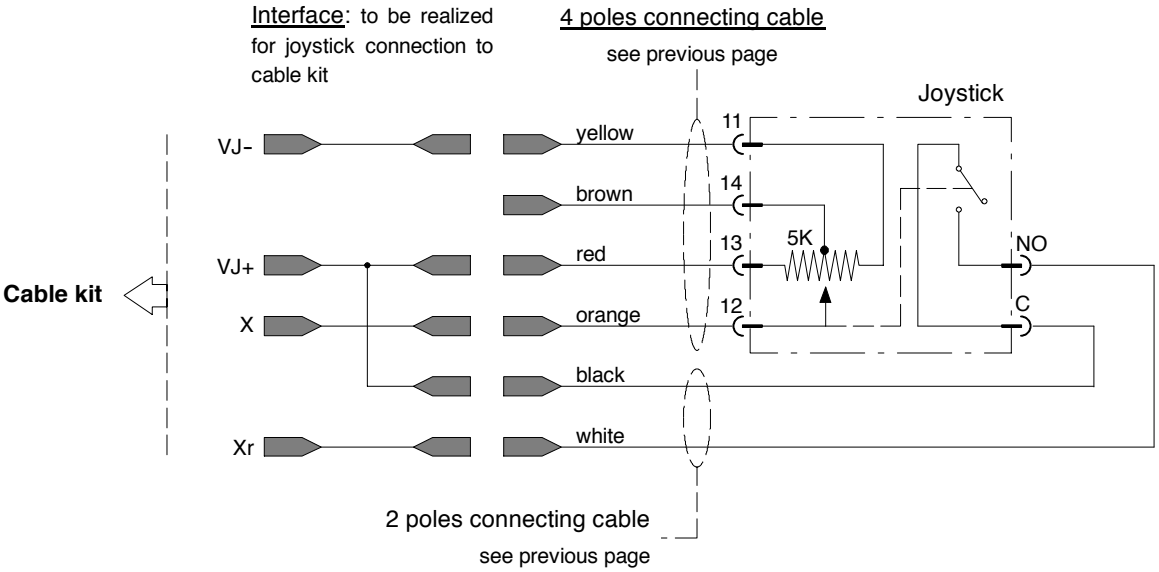


Dubox Housing 65240-004
female connector



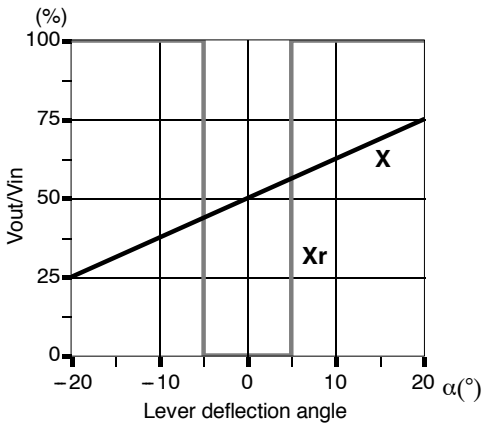
MDN131 joystick

Electric circuit



Pin	Wire colour	Description
14	brown	Center proportional signal
11	red	Supply + (VJ+)
12	orange	Proportional signal (X)
13	yellow	Supply - (VJ-)
NO	white	Signal redundancy (Xr)
C	black	Common microswitch

Output detail



S type handle

1 proportional function

Available for systems	
PHC100P ■	PHC100F □
PHC200P □	PHC200F □
PHC300P □	PHC300F □

Description

Ergonomic handle for one proportional function control.
The rubber coating with confortable grip, the robust construction, reliability and weather resistance, makes it suitable for heavy duty applications
Developed for installation on remote control inside mobile machines cabs, on armrests or fixed positions.
it's composed by

- Analog proportional rocker.
- ON/OFF front push-button.
- Electric cable with stripped wires end.

Technical data

General

Voltage supply range	from 8 to 30 VDC
Max. current absorption	10 mA
Working temperature	from -40° to +85°C
Protection degree	IP 65
EMC compatibility	EN61000-4-2/4/5
	ISO7637-0/1
	ISO13766
	ISO14892
Enviromental compatibility	IEC60068-2-6/27/29

Proportional rocker

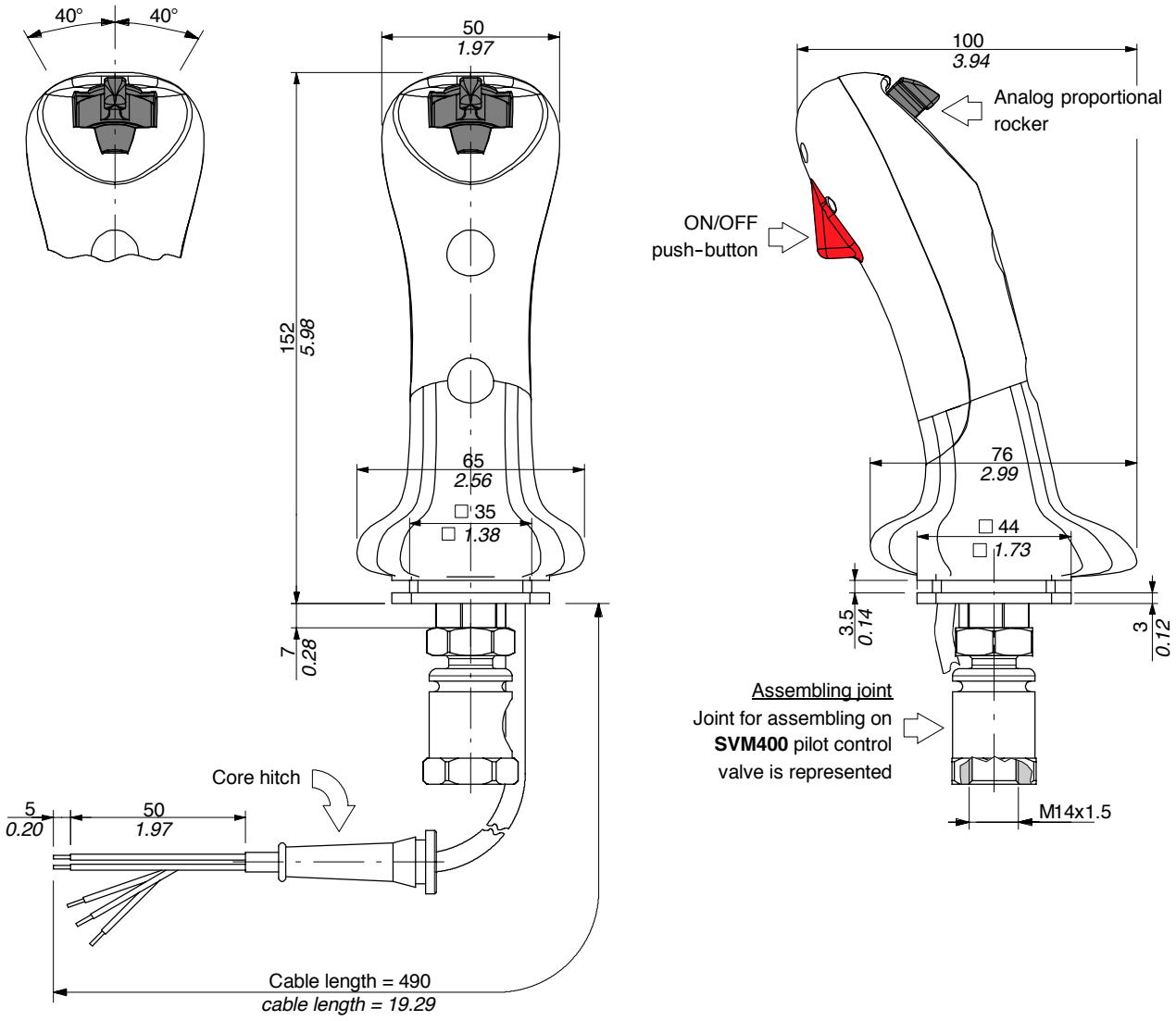
Output signal range (Vout/Vin%)	from 30% to 70%
Central position signal (Vout/Vin%)	50%
Total resistance	5 Kohm
Mechanical life (nr. of operations)	10^7
Actuator deflection	±40°

Front push-button

Contact type	normally open (NO)
Mechanical life (nr. of operations)	10^6
Electric life (nr. of operations)	$43x10^3$

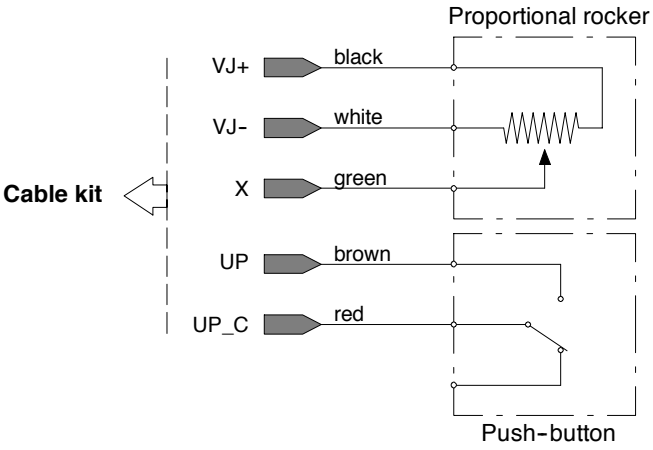
S type handle

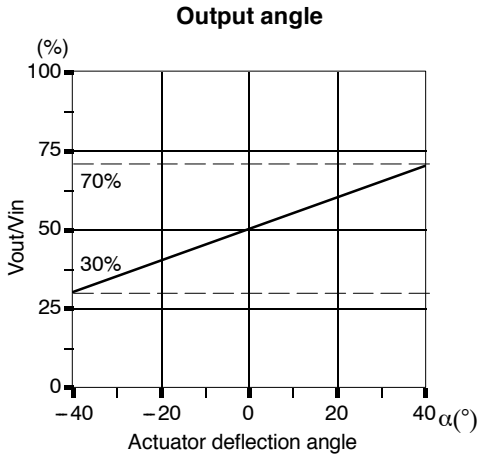
Dimensions



S type handle

Electric circuit





PROPORTIONAL ROCKER

Wire colour	Description
black	Supply + (VJ+)
green	Proportional signal (X)
white	Supply - (VJ-)

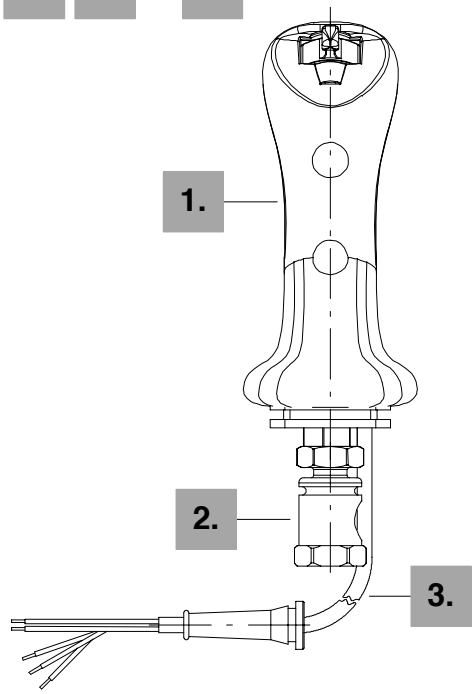
ON/OFF SWITCH

Wire colour	Description
brown	Microswitch NO contact (UP)
red	Common microswitch (UP_C)

Description example

S 11 9 - 049

1. **2.** **3.**



1. Main configuration

TYPE	DESCRIPTION
11	With proportional rocker and front push-button

2. Assembling joint

TYPE	DESCRIPTION	TYPE	DESCRIPTION
0	Standard joint	**I***	For SVM400/400EMD 19° back
7*	For SVM400-19° left	**L***	For SVM400/400EMD 30° forward
8*	For SVM400-19° right	**M***	For SVM400/400EMD 30° back
9*	For SVM400 straight type		
G*	For SVM400EMD		
H*	For SVM400/400EMD 19° forward		

NOTE (*): with core hitch

3. Cable length

TYPE	DESCRIPTION
049	Standard length 490 mm *(19.29 in)*

HZ type handle

1 ***proportional function***

Available for systems	
PHC100P☐	PHC100F■
PHC200P☐	PHC200F☐
PHC300P☐	PHC300F☐

Description

Ergonomic handle for one proportional function control.
Thanks to assembling joints and rods range, it's suitable for installation on remote control inside mobile machines cabs, on armrests or fixed positions.
it's composed by

- Analog proportional rocker with redundant signal.
- "Dead man" optional push-button
- Electric cable with sealed connectors

Technical data

General

Voltage supply range	from 8 to 30 VDC
Max. current absorption	10 mA
Working temperature	from -40° to +85°C
Protection degree	IP 65
EMC compatibility	EN61000-4-2/4/5
	ISO7637-0/1
	ISO13766
	ISO14892
Enviromental compatibility	IEC60068-2-6/27/29

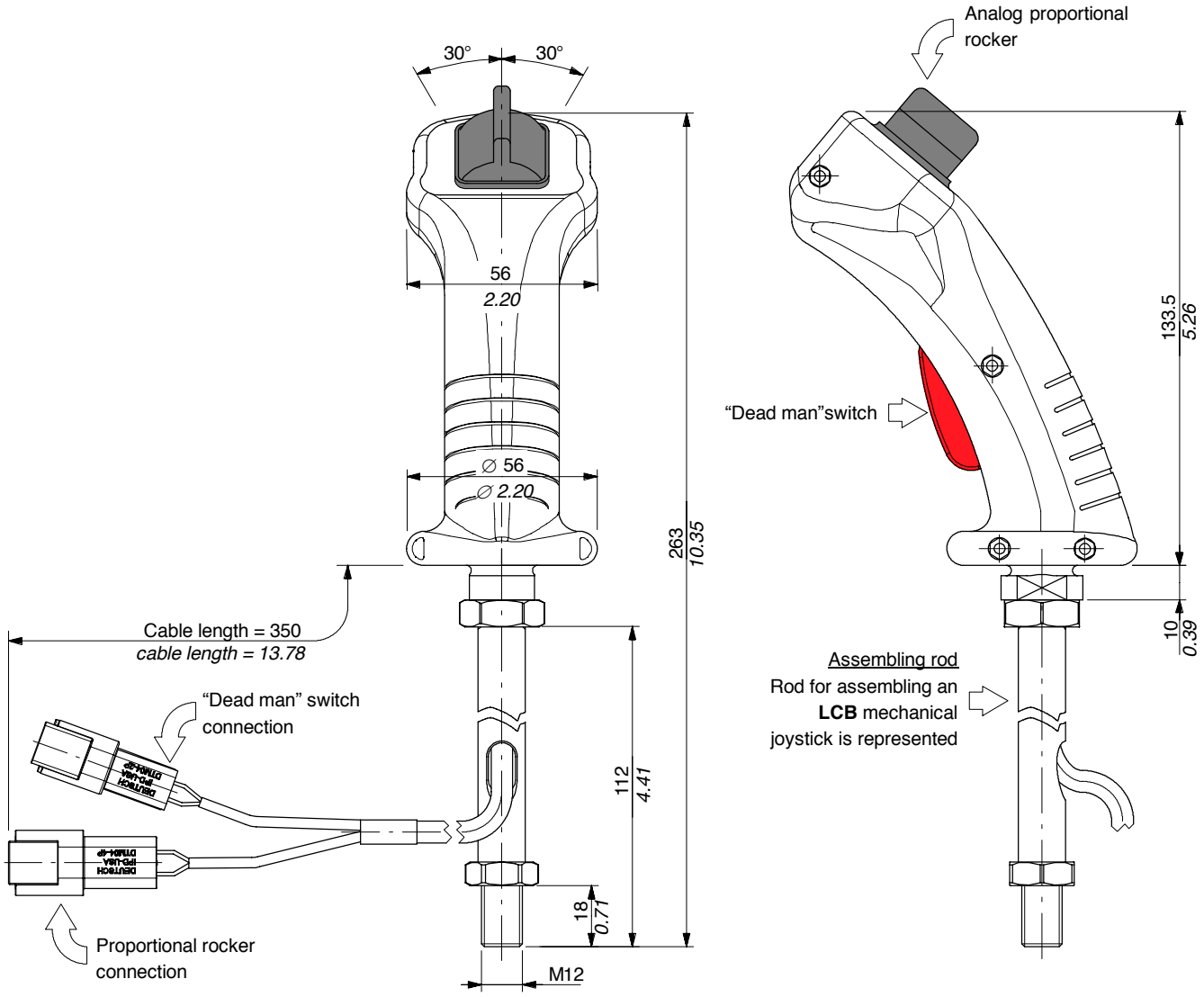
Proportional rocker

Output signal	from 0.5 to 4.5 VDC
Mechanical life (nr. of operations)	$2x10^6$
Driving force	from 4 to 6 N
	(from 0.9 to 1.3 lbf)
Actuator deflection	± 30°

"Dead man" switch

Contact type	normally open (NO)
Mechanical life (nr. of operations)	10^6
Electric life (nr. of operations)	$5x10^5$

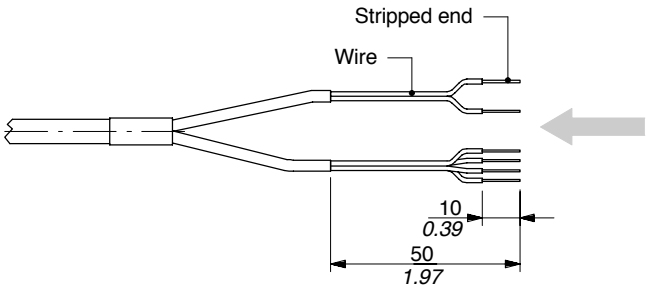
Dimensions


30°
30°
56
2.20
⌀ 56
⌀ 2.20
263
10.35
112
4.41
18
0.71
M12
Cable length = 350
cable length = 13.78
"Dead man" switch
connection
Proportional rocker
connection
Analog proportional
rocker
"Dead man"switch
133.5
5.26
10
0.39
Assembling rod
Rod for assembling an
LCB mechanical
joystick is represented

HZ type handle

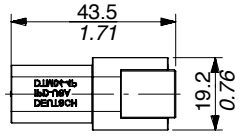
Configuration with free wires

Handle can ordered with stripped cable ends and separate connectors kit, to permits in-place assembling where required.

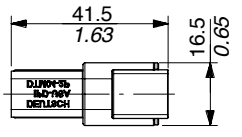


"Deutsch DTM" connectors

Connector kits complete of: housing, contacts, seals

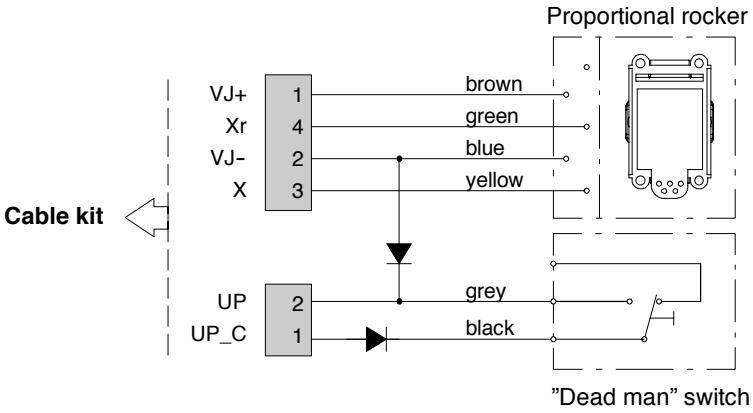


4 poles connector kit : code 5CON120036

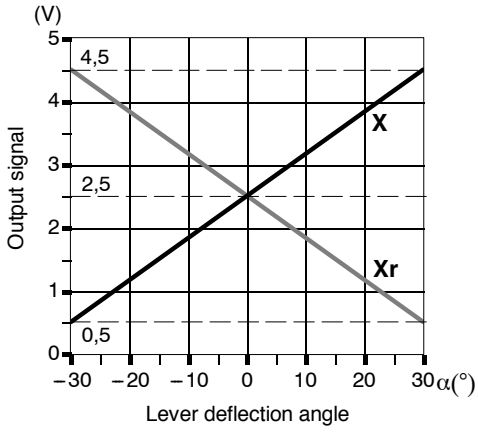


2 poles connector kit: code 5CON120041

Electric circuit



Output detail



PROPORTIONAL ROCKER

Pin	Wire colour	Description
1	brown	Supply + (VJ+)
2	blue	Supply - (VJ-)
3	yellow	Proportional signal (X)
4	green	Redundancy signal (Xr)

"DEAD MAN" SWITCH

Pin	Wire colour	Description
1	black	Common microswitch (UP_C)
2	grey	Microswitch NO contact (UP)

HZ type handle

Handle description example, with assembling joint::

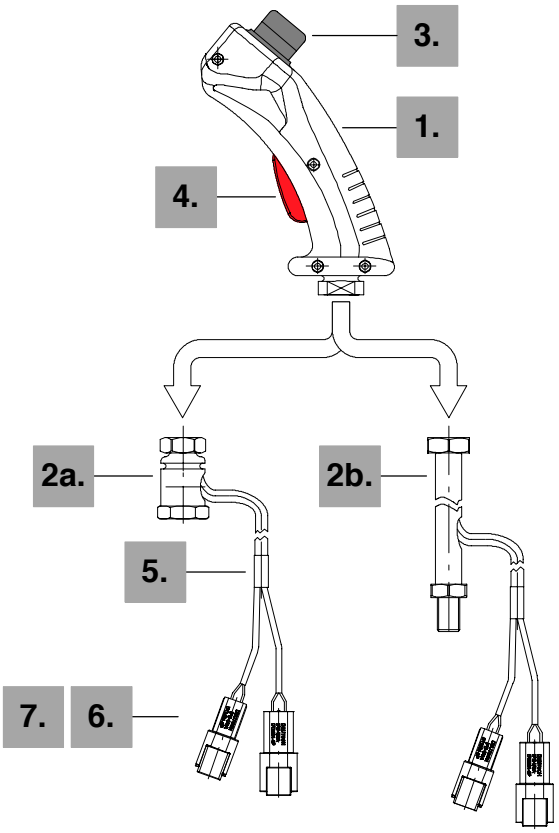
HZ A 0 - ZG1 035 (D2 F 04) - 0RD 035 (D2F 02)

1. 2a. 3. 5. 6. 7. — nr. of poles — 4.

Handle description example, with assembling rod:

AL40 - HZ A 0 - ZG1 035 (D2 F 04) - 0RD 035 (D2F 02) - M12x250

1. — without joint — 3. 5. 6. 7. — nr. of poles — 4. — 2b.



1. Configuration

TYPE	DESCRIPTION	TYPE	DESCRIPTION
A	With "dead man" switch	**B**	Without "dead man" switch

2a. Assembling joint

TYPE	DESCRIPTION	TYPE	DESCRIPTION
0	Standard joint	**I***	For SVM400/400EMD 19° back
1	For SP01	**L***	ForSVM400/400EMD 30° forward
7*	For SVM400-19° left	**M***	For SVM400/400EMD 30° back
8*	For SVM400-19° right		
9*	For SVM400, straight		
G*	For SVM400EMD		
H*	For SVM400/400EMD 19° forward		

NOTE (*): with core hitch

2b. Assembling rod

TYPE: **M10x290-20° / M10x220 / M10x250 / M10x300 / M10x350**
DESCRIPTION: With M10 thread
TYPEI: **M12x290-20° / M12x220 / M12x250 / M12x300 / M12x350**
DESCRIPTION: With M12 thread

3. Proportional rocker actuator

TYPE	DESCRIPTION
ZG0	Long lever: up-down operation
ZG1	Long lever: left-right operation
ZG2	Short rip lever: up-down operation
ZG3	Short rip lever: left-right operation
ZG8	Lever thump: up-down operation
ZG9	Lever thump: left-right operation

6. Connector type

TYPE	DESCRIPTION
D2	"Deutsch DTM" connector
O1	Without connector, with stripped end

4. "Dead man" switch

TYPE	DESCRIPTION
0RD	"Dead man" switch with red colour standard actuator

7. Connector coupling

TYPE	DESCRIPTION
F	Female connector with male ends

5. Cable length

TYPE	DESCRIPTION
035	Standard length 350 mm *(13.78 in)*

MDT119H joystick

1 *proportional function*

Available for systems	
PHC100P☐	PHC100F■
PHC200P☐	PHC200F☐
PHC300P☐	PHC300F☐

Description

Joystick is composed by a single axis body and Series H ergonomic handle with optional “dead man” switch.
Rugged construction and high sensitivity makes it ideal for heavy duty application.

- Contactless sensing control with redundancy signal.
- Wide mechanical life.
- Two sensor per axis.
- Integrated temperature compensation.
- Ergonomic handle with “dead man” switch.

Technical data

General

Voltage supply range	: from 8 to 30 VDC
Max. current absorption	: 180 mA
Working temperature range	: from -40° to +85°C
Protection degree	: IP 65
EMC compatibility	: EN61000-4-2/4/5 ISO7637-0/1 ISO13766 ISO14892
Enviromental compatibility	: IEC60068-2-6/27/29

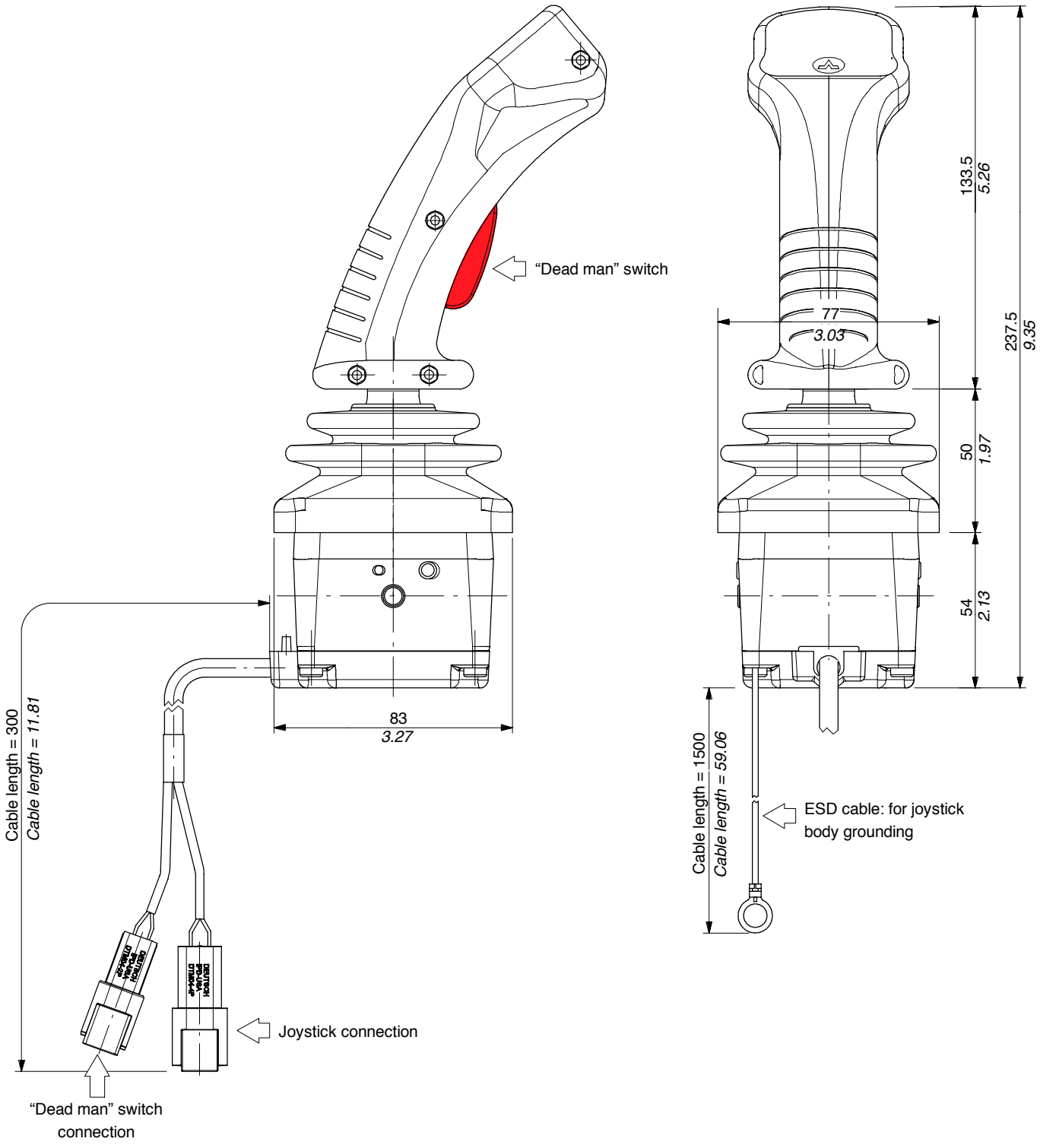
Joystick

Output signal	: from 0.5 to 4.5 VDC
Mechanical life (n^r of operations)	: 5x10^6
Driving force (measured 140 mm - *0.55 in* from pivot)	: 12 N *(2.7 lbf)*
Horizontal max. load	: 100 N *(22.5 lbf)*
Vertical max. load	: 1000 N *(225 lbf)*
Max. torque (vertical axis)	: 20 Nm *(4.5 lbf)*
Lever deflection	: ±20°
Center position tolerance	: ±2°

“Dead man” switch

Contact type	: normally open (NO)
Mechanical life (n^r. of operations)	: 10^6
Electric life (n^r. of operations)	: 5x10^5

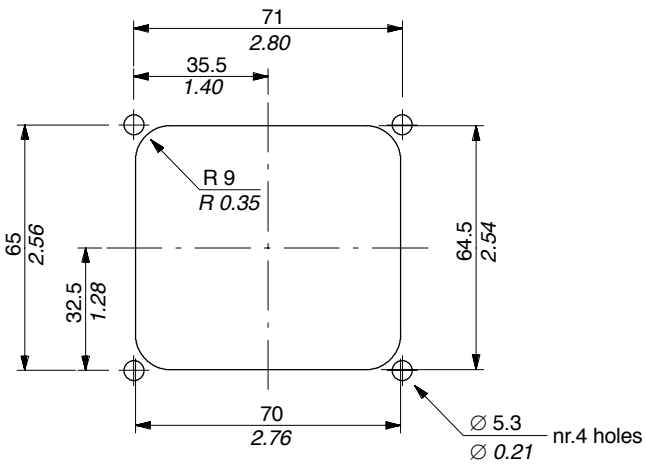
Dimensions


"Dead man" switch
133.5
5.26
237.5
9.35
77
3.03
50
1.97
54
2.13
83
3.27
Cable length = 300
Cable length = 11.81
Cable length = 1500
Cable length = 59.06
ESD cable: for joystick body grounding
Joystick connection
"Dead man" switch connection

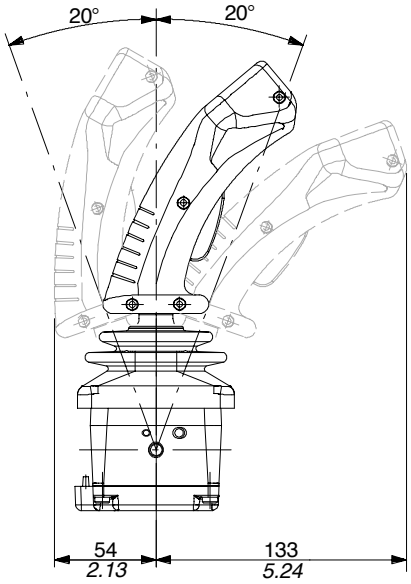
MDT119H joystick

Dimension

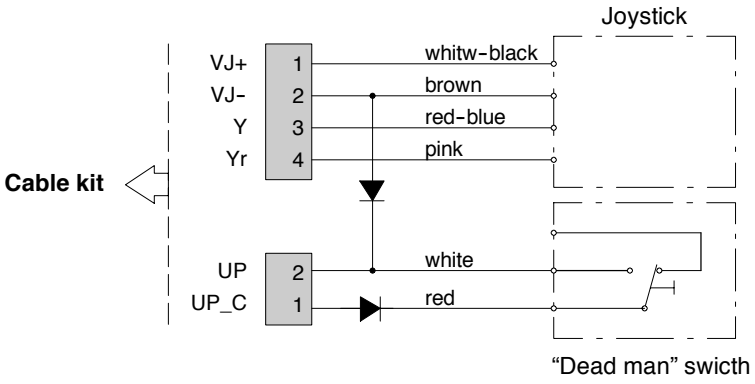
Panel cut out



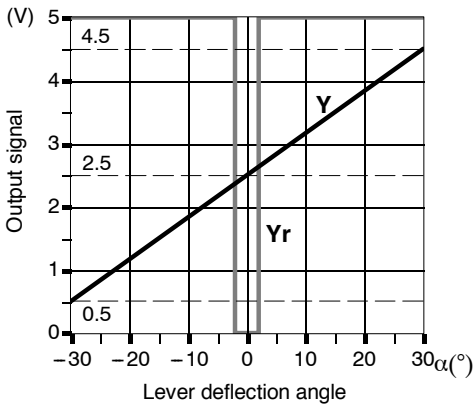
Lever deflection angle



Electric circuit



Output detail



PROPORTIONAL ROCKER

Pin	Wire colour	Description
1	white-black	Supply + (VJ+)
2	brown	Supply - (VJ-)
3	red-blue	Proportional signal (Y)
4	pink	Redundancy signal (Yr)

"DEAD MAN" SWITCH

Pin	Wire colour	Description
1	red	Common microswitch (UP_C)
2	white	Microswitch NO contact (UP)

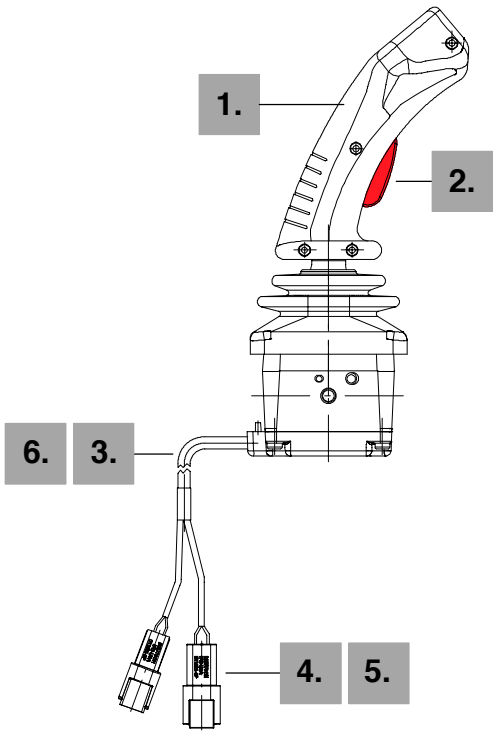
MDT119H joystick

Description example:

MDT119H A 00C - 0RD / 01 D2 F 04 030 - 02 D2 F 02 030 + ESD cable L=1.5

1. 2. 3. 4. 5. 6.

nr. of poles



1. Configuration

TYPE	DESCRIPTION
A	With “dead man” switch
B	Without “dead man” switch

2. “Dead man” switch

TYPE	DESCRIPTION
0RD	“Dead man” switch with red colour standard actuator

3. Cable reference

TYPE	DESCRIPTION
01	Joystick connection
02	“Dead man” switch connection

4. Connector type

TYPE	DESCRIPTION
D2	“Deutsch DTM” connector

5. Connector coupling

TYPE	DESCRIPTION
F	Female connector with male ends

6. Cable length

TYPE	DESCRIPTION
030	Standard length 300 mm *(11.81 in)*: the dimension is referred to cable total length and includes also the part inside the joystick

MDN231 joystick

2 ***proportional functions***

Available for systems	
PHC100P□	PHC100F□
PHC200P■	PHC200F□
PHC300P■	PHC300F□

Description

The joystick MDN231 has been specifically designed to provide the control of two proportional functions and meet the mobile machines today's market requirements.

Developed for applications where ergonomics and precise proportional control are required, the MDN231 is a low profile design joystick with fingetip control; its low operating force minimize repetitive stresses and operator fatigue.

Compact dimensions makes it suitable for installation with reduced operation space as armrests and remote control chest packs.

In applications where operations assurance, wide lifetime and maintenance absence are decisive features, the MDN231 provides reliability and operating simplicity.

Technical data

General

Max. supply voltage (Vin) . . . . . : 35VDC
Power absoption . . . . . : 0.2W (@ 40°C)
Lever deflection . . . . . : ±20°
Average lifetime (n^r of operation) . . . : > 2.8 x10^6
Working temperature . . . . . : from -20° C to +70° C
Protection degree (over fixing plan) . : IP65
Connector . . . . . : Dupont Dubox

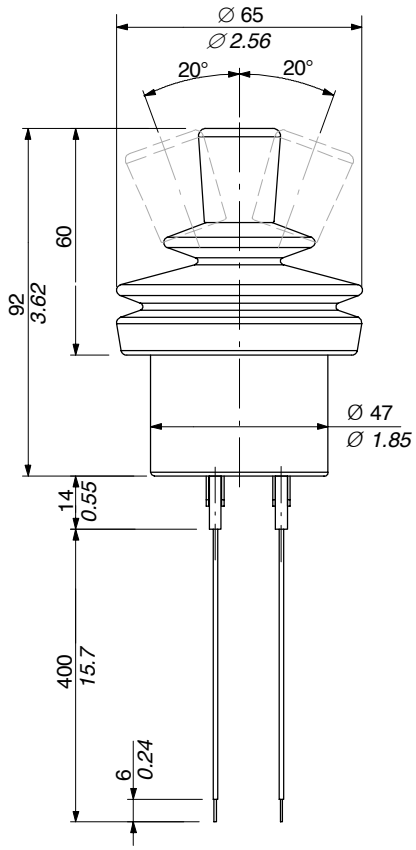
Analog track

Total resistance . . . . . : 5kΩ ±20%
Output signal range (Vout/Vin%) . . . : from 25% to 75%
Central position signal (Vout/Vin%) : 50%

Center off switch

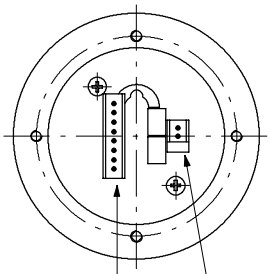
Switch center gap . . . . . : 5° either directions

Dimensions



Joystick bottom view

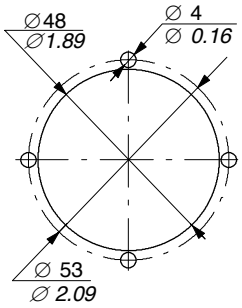
(cable less: for cable kit see next page)



Dubox Plug 76384-308
8 poles male connector

Dubox Plug 76384-302
2 poles male connector

Panel cut out

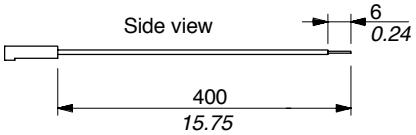


Connecting cable

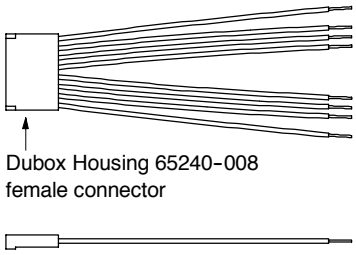
Connecting cables are supplyed with the joystick, but they are also available as spare parts: they consisting of a female connector and AWG24 wires with tin-plate treminals.

2 poles cable: code **W0450001**

Dubox Housing 65240-002
female connector



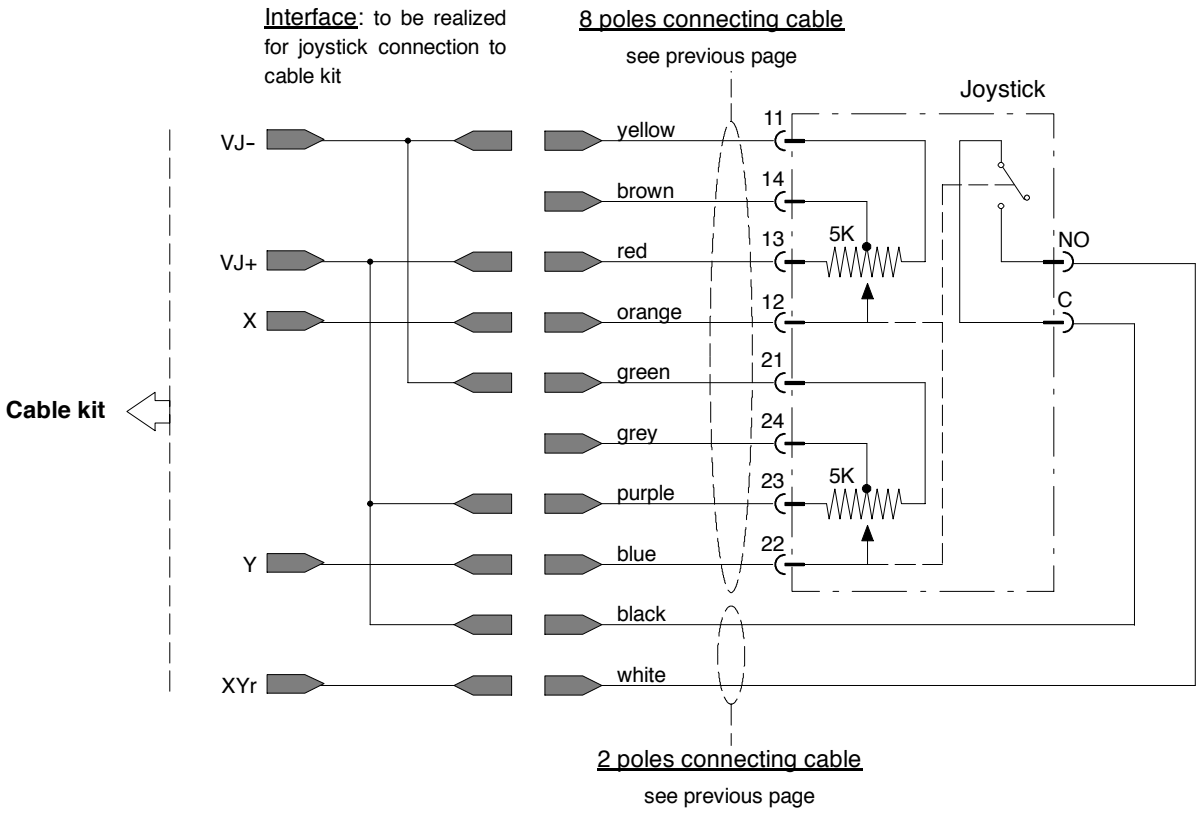
8 poles cable code: **W0450004**



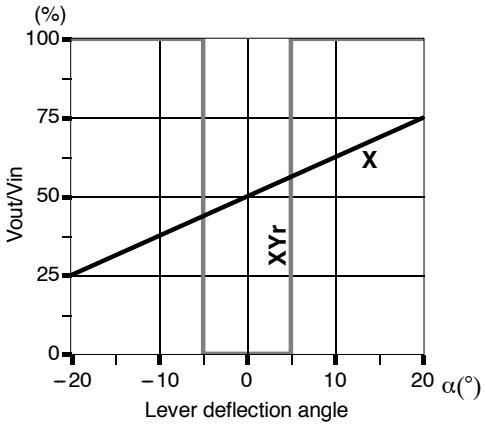
Dubox Housing 65240-008
female connector

MDN231 joystick

Electric circuit



Output detail



Pin	Wire colour	Description
11	yellow	Supply -, X axis (VJ-)
12	orange	Proportional signal, X axis (X)
13	red	Supply +, X axis (VJ+)
14	brown	Center proportional signal, X axis
21	green	Supply -, Y axis (VJ-)
22	blue	Proportional signal, Y axis (Y)
23	purple	Supply +, Y axis (VJ+)
24	grey	Center proportional signal, Y axis
NO	whitw	Redundancy signal, X and Y axis (XYr)
C	black	Common microswitch (VJ+)

PZ type handle

2 proportional functions

Available for systems	
PHC100P ☐	PHC100F ☐
PHC200P ☐	PHC200F ■
PHC300P ☐	PHC300F ☐

Description

Ergonomic handle for two proportional function control.
Thanks to assembling joints and rods range, it's suitable for installation on remote control inside mobile machines cabs, on armrests or fixed positions.
it's composed by

- Two proportional rockers with redundant signal.
- "Dead man" optional push-button
- Electric cable with sealed connectors

Technical data

General

Voltage supply range	from 8 to 30 VDC
Max. current absorption	20 mA
Working temperature	from -40° to +85°C
Protection degree	IP 65
EMC compatibility	EN61000-4-2/4/5 ISO7637-0/1 ISO13766 ISO14892
Enviromental compatibility	IEC60068-2-6/27/29

Proportional rocker

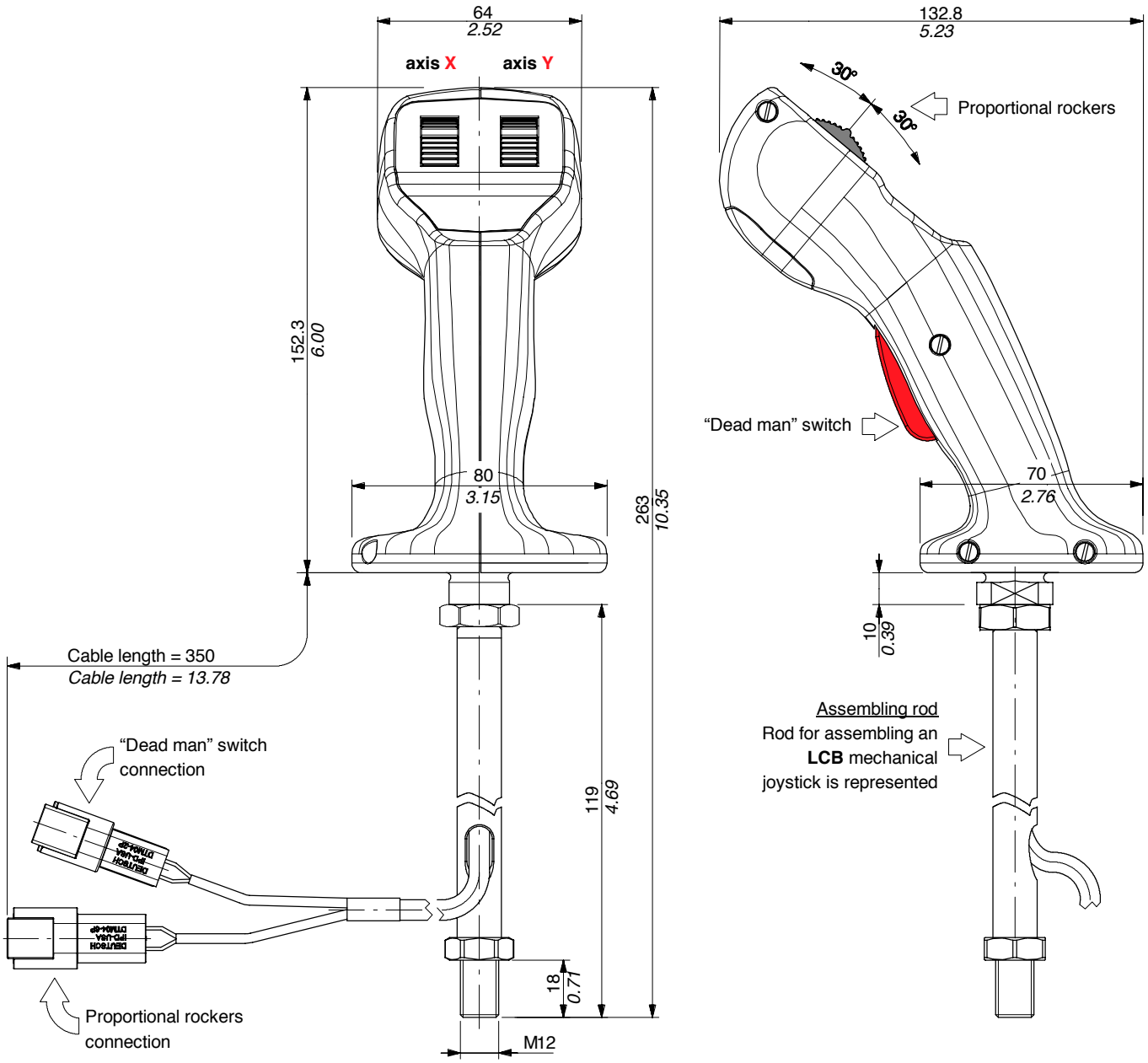
Output signal	from 0.5 to 4.5 VDC
Mechanical life (nr. of operations)	$2x10^6$
Driving force	from 4 to 6 N *(from 0.9 to 1.3 lbf)*
Actuator deflection	± 30°

"Dead man" switch

Contact type	normally open (NO)
Mechanical life (nr. of operations)	10^6
Electric life (nr. of operations)	$3x10^4$

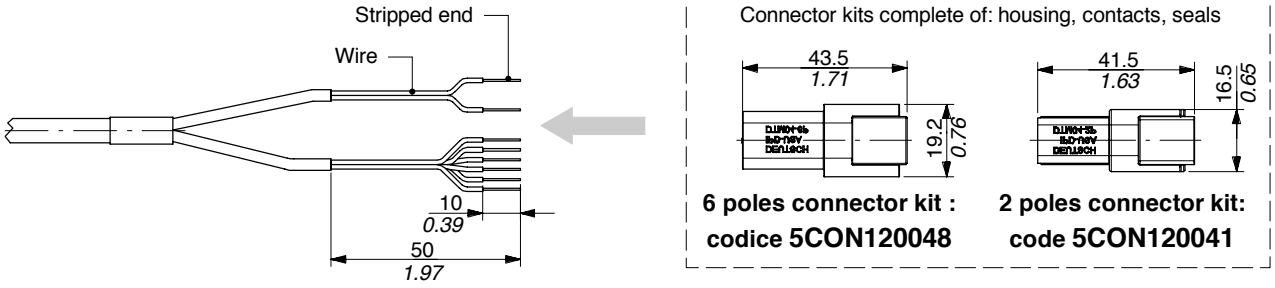
PZ type handle

Dimensions

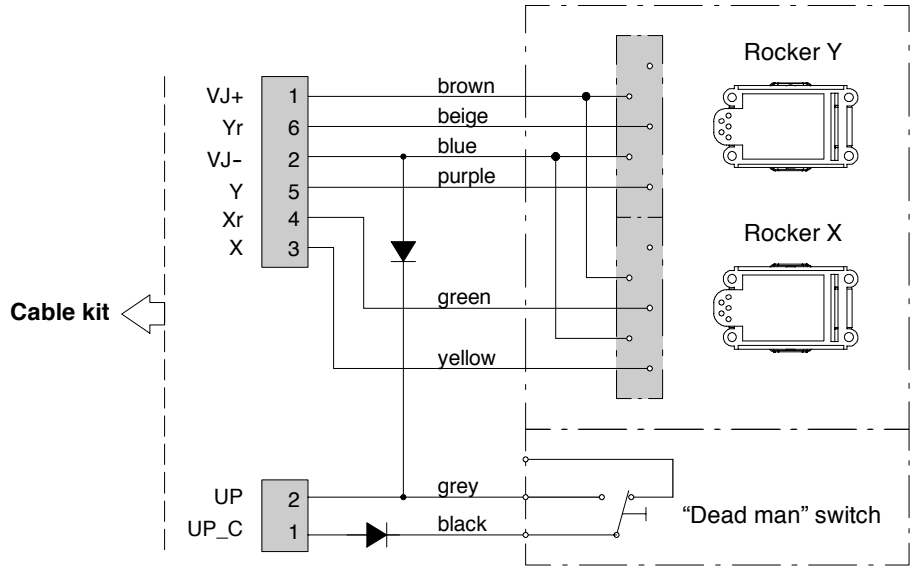


Configuration with free wires

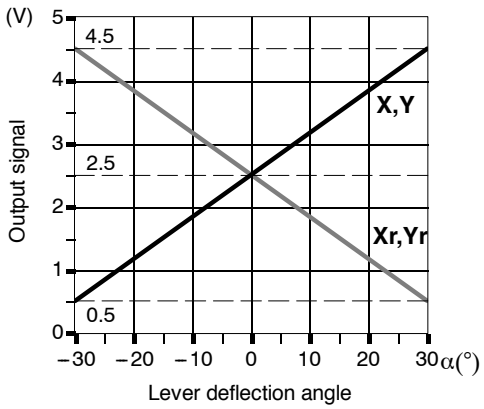
Handle can ordered with stripped cable ends and separate connectors kit, to permits in-place assembling where required.



Electric circuit



Output detail



PROPORTIONAL ROCKER

Pin	Wire colour	Description
1	brown	Supply + (VJ+)
2	blue	Supply - (VJ-)
3	yellow	Proportional signal, X axis (X)
4	green	Redundancy signal, X axis (Xr)
5	purple	Proportional signal, Y axis (Y)
6	beige	Redundancy signal Y (Yr)

"DEAD MAN" SWITCH

Pin	Wire colour	Description
1	black	Common microswitch (UP_C)
2	grey	Microswitch NO contact (UP)

PZ type handle

Handle description example, with assembling joint:

AL80 – PZ A 0200A 9 – 0RD 035 (D2 F 02) – X G3 035 (u) – YG3035 (D2F06)

1. 2a. 3. 6. 7. 8. 4. 5.

nr. of poles

Only one connector for both potentiometers

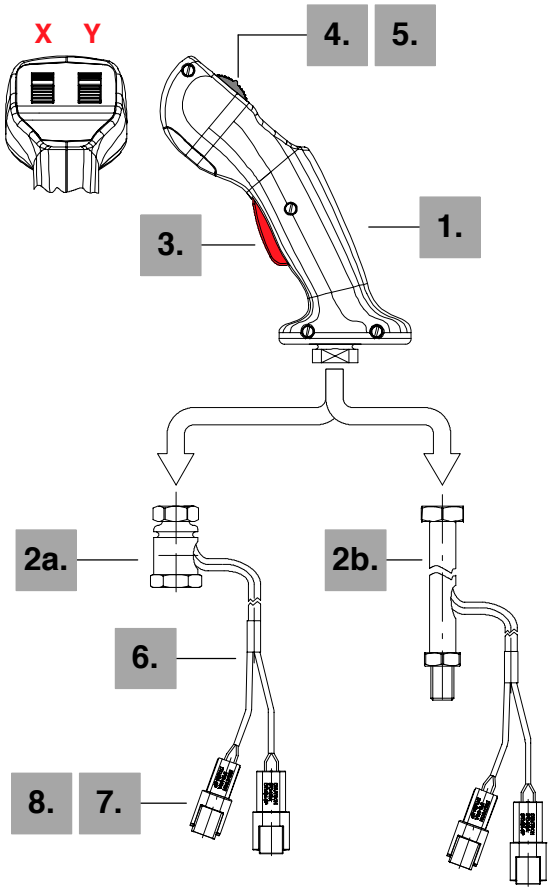
Handle description example, with assembling rod:

AL80 – PZ A 0200A 0 – 0RD 035 (D2 F 02) – X G3 035 (u) – Y G3 035 (D2 F 06) – M12x280

Without joint

Only one connector for both potentiometers

2b.



1. Configuration

TYPE	DESCRIPTION	TYPE	DESCRIPTION
A	With “dead man” switch	**B**	Without “dead man” switch

2a. Assembling joint

TYPE	DESCRIPTION	TYPE	DESCRIPTION
0	Standard joint	**I***	For SVM400/400EMD 19° back
1	For SP01	**L***	ForSVM400/400EMD 30° forward
7*	For SVM400-19° left	**M***	For SVM400/400EMD 30° back
8*	For SVM400-19° right		
9*	For SVM400, straight		
G*	For SVM400EMD		
H*	For SVM400/400EMD 19° forward		

NOTE (*): with core hitch

2b. Assembling rod

TYPE: **M10x290-20° / M10x220 / M10x250 / M10x300 / M10x350**
DESCRIPTION: With M10 thread
TYPE: **M12x290-20° / M12x220 / M12x250 / M12x280 / M12x300 / M12x350**
DESCRIPTION: With M12 thread

3. “Dead man” switch

TYPE	DESCRIPTION
0RD	“Dead man” switch with red colour standard actuator

4. Proportional rocker reference

TYPE	DESCRIPTION
X	Left rocker (axis X operation)
Y	Right rocker (axis Y operation)

5. Proportional rocker actuator

TYPE	DESCRIPTION	TYPE	DESCRIPTION
G3	Knurled actuator	**G4**	Paddle actuator

6. Cable length

TYPE	DESCRIPTION
035	Standard length 350 mm *(13.78 in)*

7. Connector type

TYPE	DESCRIPTION
D2	“Deutsch DTM” connector
O1	Without connector, with stripped end

8. Connector coupling

TYPE	DESCRIPTION
F	Female connector with male ends

MDT219H joystick

2 *proportional functions*

Available for systems	
PHC100P☐	PHC100F☐
PHC200P☐	PHC200F■
PHC300P☐	PHC300F☐

Description

Joystick is composed by a double axis body and Series H ergonomic handle with optional “dead man” switch.
Rugged construction and high sensitivity makes it ideal for heavy duty application.

- Contactless sensing control with redundancy signal.
- Wide mechanical life.
- Two sensor per axis.
- Integrated temperature compensation.
- Ergonomic handle with “dead man” switch.

Technical data

General

Voltage supply range	: from 8 to 30 VDC
Max. current absorption	: 180 mA
Working temperature range	: from -40° to +85°C
Protection degree	: IP 65
EMC compatibility	: EN61000-4-2/4/5 ISO7637-0/1 ISO13766 ISO14892
Enviromental compatibility	: IEC60068-2-6/27/29

Joystick

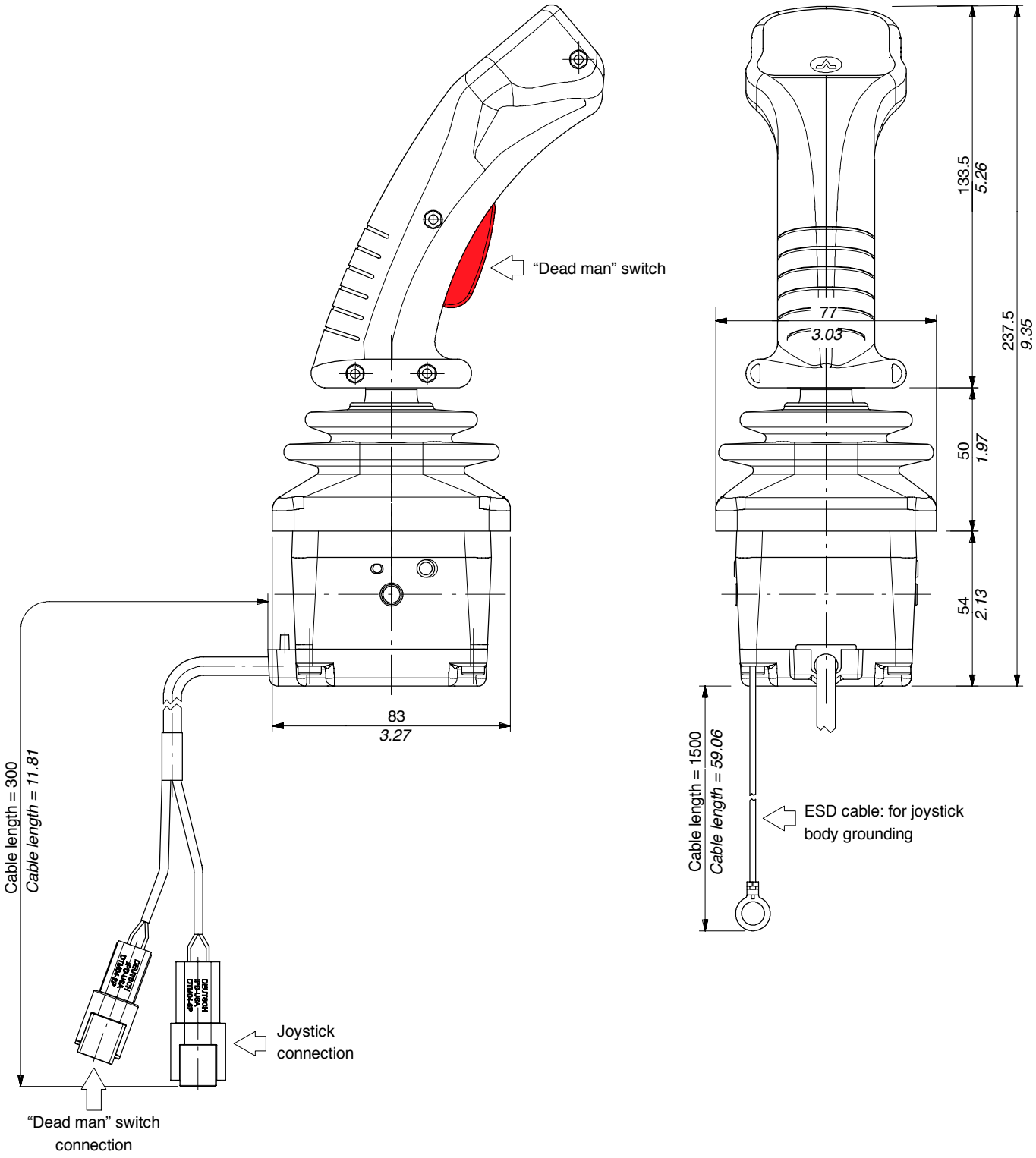
Output signal	: from 0.5 to 4.5 VDC
Mechanical life (n^r of operations)	: 5x10^6
Driving force (measured 140 mm - *0.55 in* from pivot)	: 12 N *(2.7 lbf)*
Horizontal max. load	: 100 N *(22.5 lbf)*
Vertical max. load	: 1000 N *(225 lbf)*
Max. torque (vertical axis)	: 20 Nm *(4.5 lbf)*
Lever deflection	: ±20°
Center position tolerance	: ±2°

“Dead man” switch

Contact type	: normally open (NO)
Mechanical life (n^r. of operations)	: 10^6
Electric life (n^r. of operations)	: 5x10^5

MDT219H joystrick

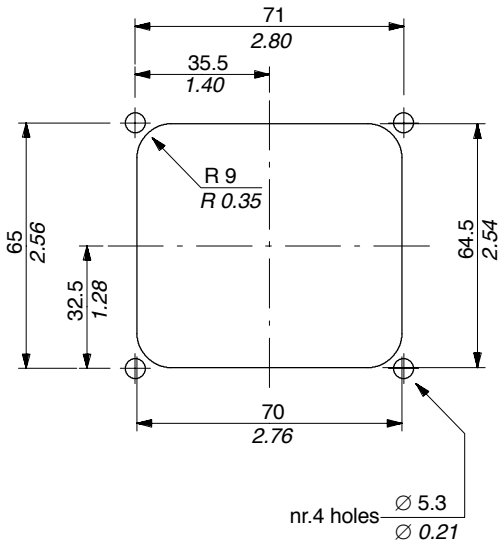
Dimensions



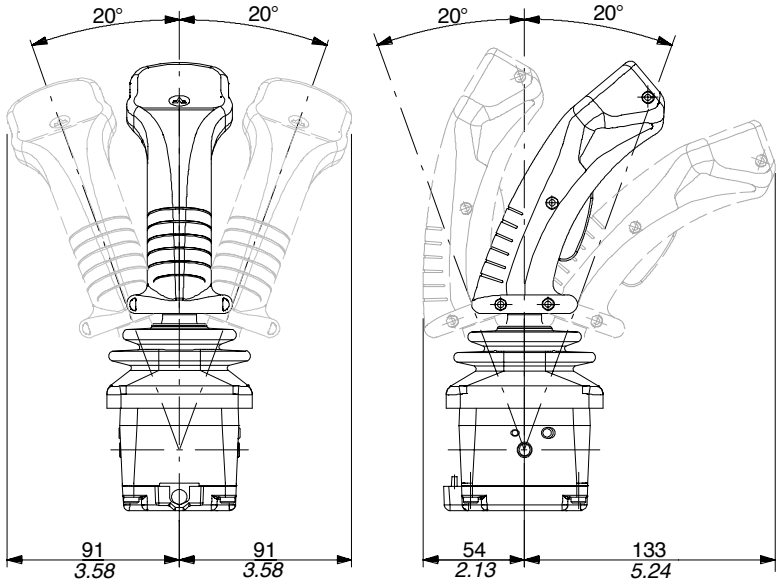
MDT219H joystick

Dimensions

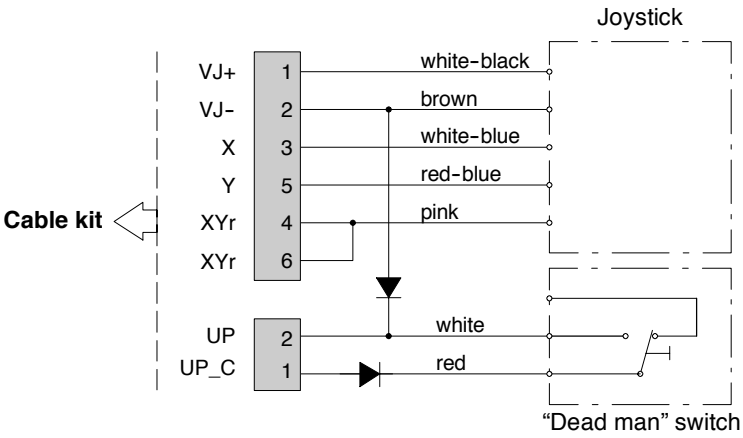
Panel cut out



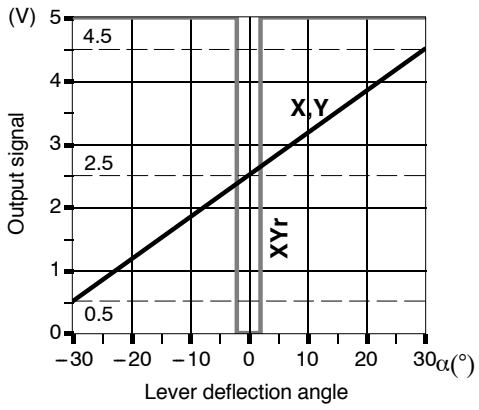
Lever deflection angle



Electric circuit



Output detail



JOYSTICK

Pin	Wire colour	Description
1	white-black	Supply + (VJ+)
2	brown	Supply - (VJ-)
3	white-blue	Proportional signal, X axis (X)
4	pink	Redundancy signal, X and Y axis (XYr)
5	red-blue	Proportional signal, Y axis (Y)
6	pink	Redundancy signal, X and Y axis (XYr)

"DEAD MAN" SWITCH

Pin	Wire colour	Description
1	red	Common microswitch (UP_C)
2	white	Microswitch NO contact (UP)

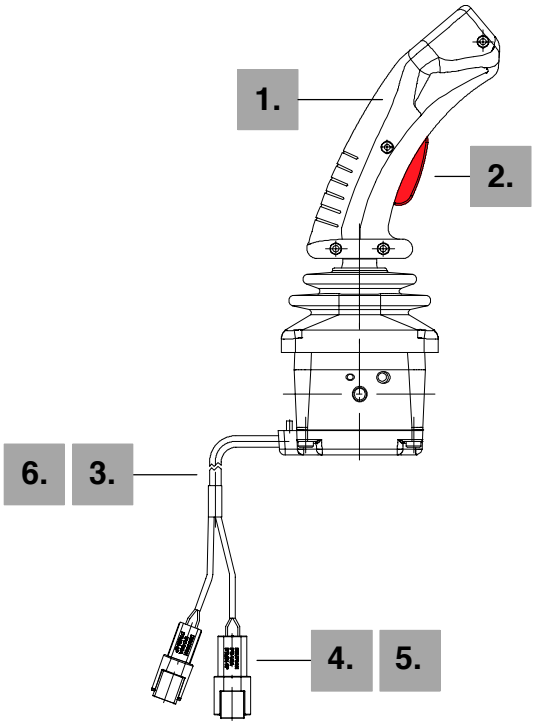
MDT219H joystick

Description example:

MDT219H A 00C 0RD / 01 D2 F 06 030 - 02 D2 F 02 030 + ESD cable L=1.5

1. 2. 3. 4. 5. 6.

nr. of poles



1. Configuration

TYPE	DESCRIPTION
A	With “dead man” switch
B	Without “dead man” switch

2. “Dead man” switch

TYPE	DESCRIPTION
0RD	“Dead man” switch with red colour standard actuator

3. Cable reference

TYPE	DESCRIPTION
01	Joystick connection
02	“Dead man” switch connection

4. Connector type

TYPE	DESCRIPTION
D2	“Deutsch DTM” connector

5. Connector coupling

TYPE	DESCRIPTION
F	Female connector with male ends

6. Cable length

TYPE	DESCRIPTION
030	Standard length 300 mm *(11.81 in):* the dimension is referred to cable total length and includes also the part inside the joystick

MDT219HZ joystick

3 *proportional functions*

Available for systems	
PHC100P☐	PHC100F☐
PHC200P☐	PHC200F☐
PHC300P☐	PHC300F■

Description

Joystick is composed by a double axis body and Series HZ ergonomic handle with analogue proportional rocker and optional “dead man” switch

Rugged construction and high sensitivity makes it ideal for heavy duty application.

- Contactless sensing joystick with redundancy signal for each axis.
- Redundant signal.
- Wide mechanical life.
- Two sensor per axis.
- Integrated temperature compensation.
- Ergonomic handle with “dead man” switch.

Technical data

General

Voltage supply range	from 8 to 30 VDC
Max. current absorption	< 200 mA
Working temperature	from -40° to +85°C
Protection degree	IP 65
EMC compatibility	EN61000-4-2/4/5 ISO7637-0/1 ISO13766 ISO14892
Enviromental compatibility	IEC60068-2-6/27/29

Joystick

Output signal	from 0.5 to 4.5 VDC
Mechanical life (n^r of operations)	5x10^6
Driving force (measured 140 mm - *0.55 in* from pivot)	12 N *(2.7 lbf)*
Horizontal max. load	100 N *(22.5 lbf)*
Vertical max. load	1000 N *(225 lbf)*
Max. torque (vertical axis)	20 Nm *(4.5 lbf)*
Lever deflection	±20°
Center position tolerance	±2°

Proportional rocker

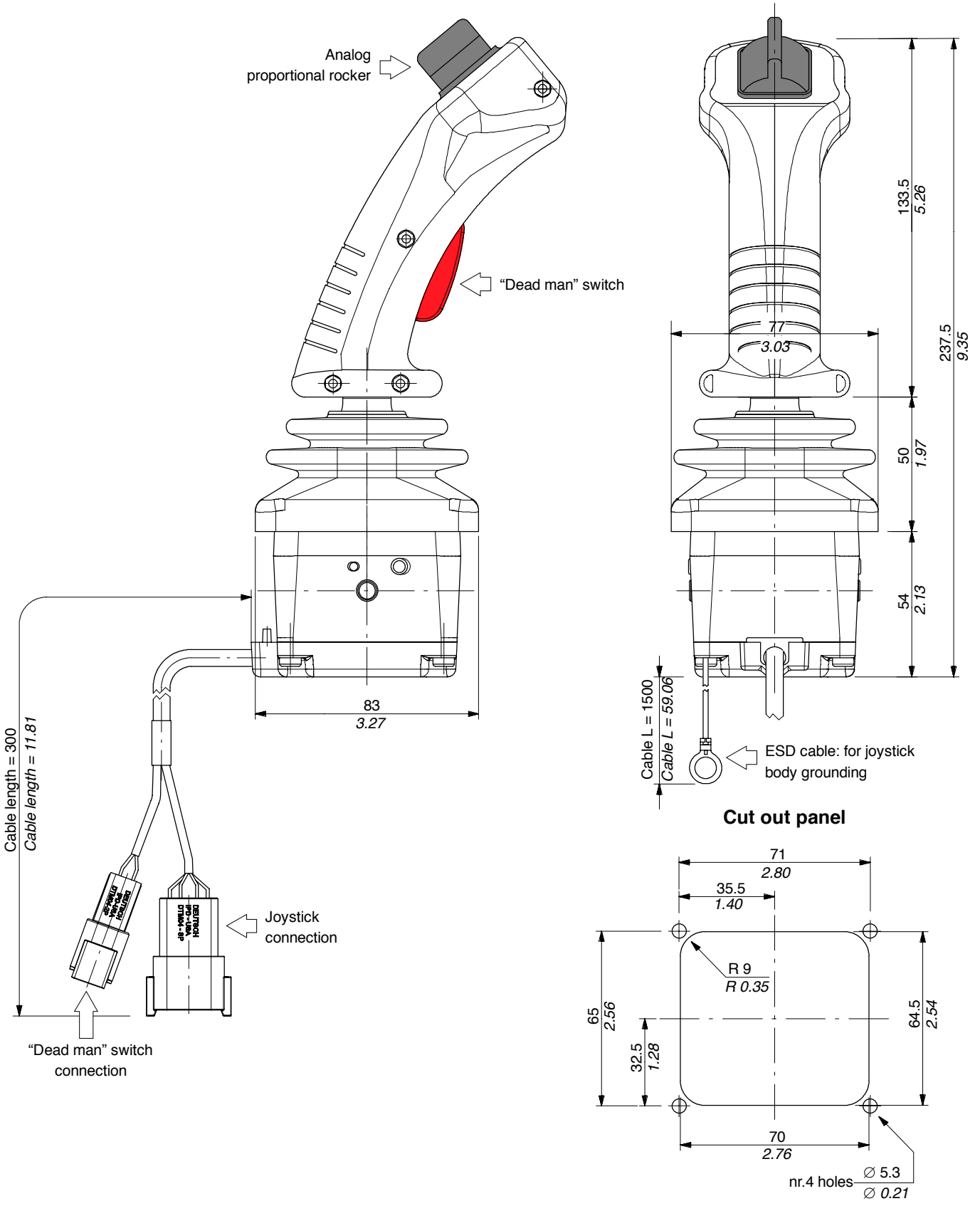
Output signal	from 0.5 to 4.5 VDC
Mechanical life (n^r. of operations)	2x10^6
Driving force	from 4 to 6 N *(from 0.9 to 1.3 lbf)*
Actuator deflection	± 30°

“Dead man” switch

Contact type	normally open (NO)
Mechanical life (n^r. of operations)	10^6
Electric life (n^r. of operations)	5x10^5

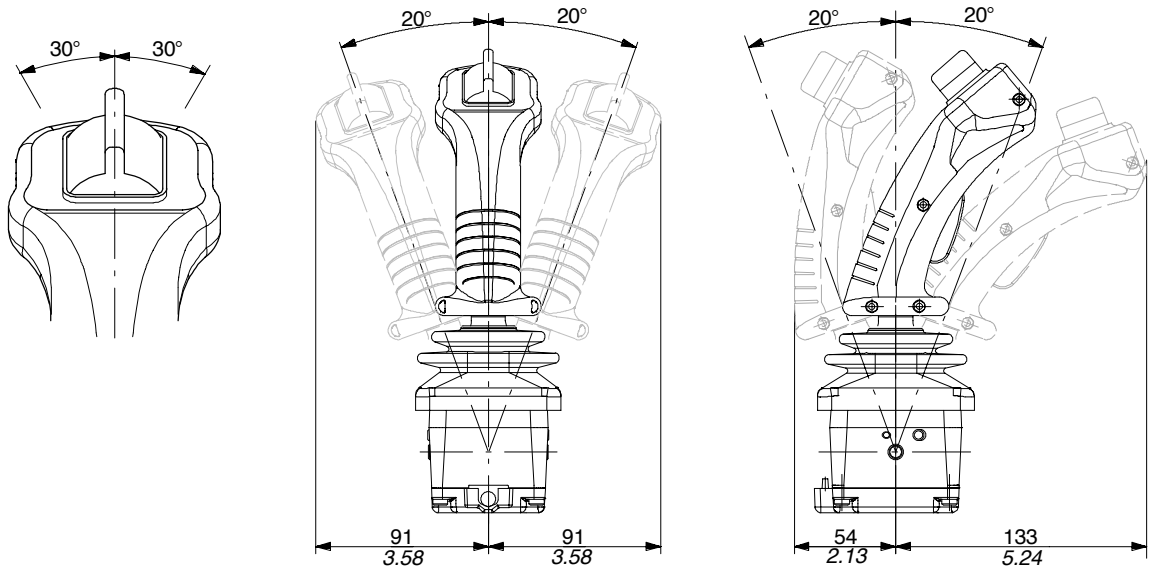
MDT219HZ joystick

Dimensions

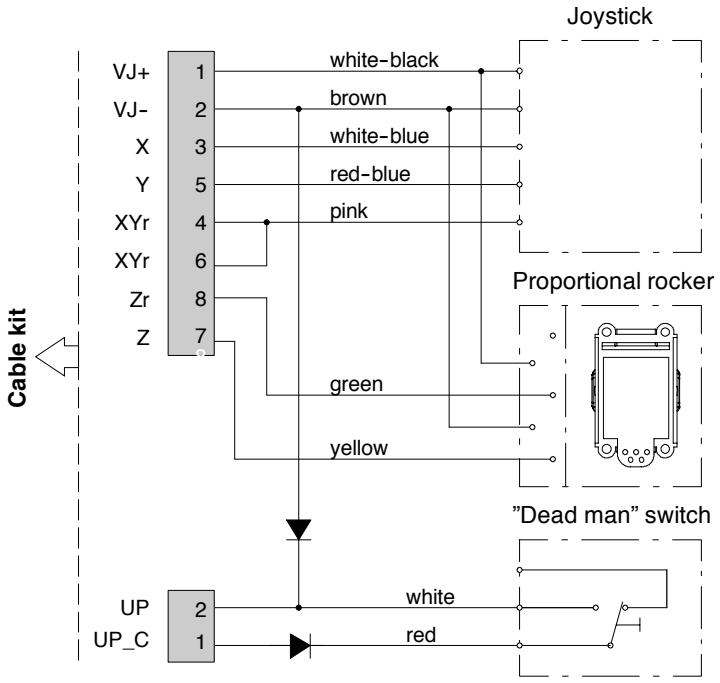


MDT219HZ joystick

Lever deflection angle



Electric circuit



JOYSTICK

Pin	Wire colour	Description
1	white-black	Supply + (VJ+)
2	brown	Supply - (VJ-)
3	white-blue	Proportional signal, X axis (X)
4	pink	Redundancy signal, X and Y axis (XYr)
5	red-blue	Proportional signal, Y axis (Y)
6	pink	Redundancy signal, X and Y axis (XYr

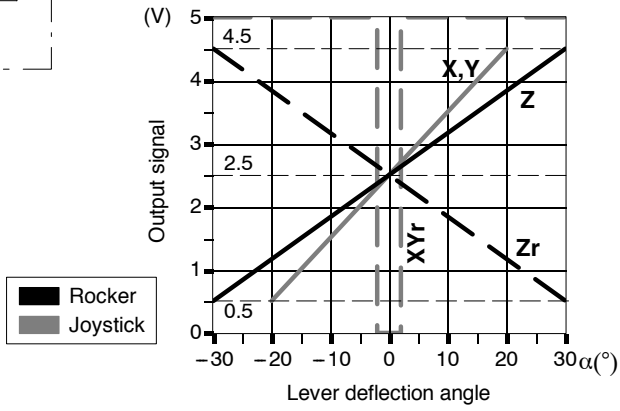
PROPORTIONAL ROCKER

7	yellow	Proportional signal, Z axis (Z)
8	green	Redundancy signal, Z axis (Zr)

"DEAD MAN" SWITCH

Pin	Wire colour	Description
1	red	Common microswitch (UP_C)
2	white	Microswitch NO contact (UP)

Output detail



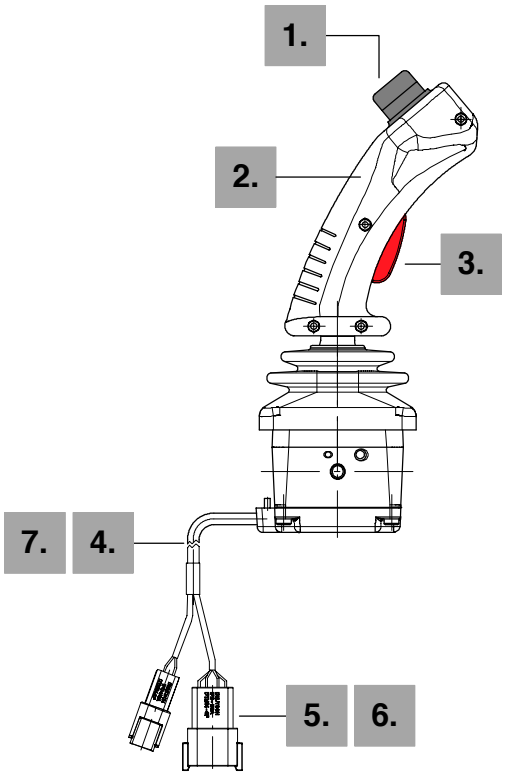
MDT219HZ joystick

Description example:

MDT219HZ A C – ZG1 – 0RD / 01 D2 F 08 030 – 02 D2 F 02 030 + ESD cable L=1.5

1. 2. 3. 4. 5. 6. 7.

nr. of poles



1. Handle configuration

TYPE	DESCRIPTION
A	With “dead man” switch
B	Without “dead man” switch

2. Proportional rocker actuator

TYPE	DESCRIPTION
ZG0	Long lever: up-down operation
ZG1	Long lever: left-right operation
ZG2	Short rip lever: up-down operation
ZG3	Short rip lever: left-right operation
ZG8	Lever thump: up-down operation
ZG9	Lever thump: left-right operation

3. “Dead man” switch

TYPE	DESCRIPTION
0RD	“Dead man” switch with red colour standard actuator

4. Cable reference

TYPE	DESCRIPTION
01	Joystick connection
02	“Dead man” switch connection

5. Connector type

TYPE	DESCRIPTION
D2	“Deutsch DTM” connector

6. Connector coupling

TYPE	DESCRIPTION
F	Female connector with male ends

7. Cable length

TYPE	DESCRIPTION
030	Standard length 300 mm *(11.81 in)*: the dimension is referred to cable total length and includes also the part inside the joystick

MDT219PZ joystick

3 *proportional function*

Available for systems	
PHC100P☐	PHC100F☐
PHC200P☐	PHC200F☐
PHC300P☐	PHC300F■

Description

Joystick is composed by a double axis body and Series PZ ergonomic handle with analogue proportional rocker and optional “dead man” switch

Rugged construction and high sensitivity makes it ideal for heavy duty application.

- Contactless sensing joystick with redundancy signal for each axis.
- Redundant signal.
- Wide mechanical life.
- Two sensor per axis.
- Integrated temperature compensation.
- Ergonomic handle with “dead man” switch.

Technical data

General

Voltage supply range . . . . . : from 8 to 30 VDC
Max. current absorption . . . . . : < 200 mA
Working temperature . . . . . : from -40° to +85°C
Protection degree . . . . . : IP 65
EMC compatibility . . . . . : EN61000-4-2/4/5
ISO7637-0/1
ISO13766
ISO14892
Enviromental compatibility . . . . . : IEC60068-2-6/27/29

Joystick

Output signal . . . . . : from 0.5 to 4.5 VDC
Mechanical life (n^r of operations) . . . : 5x10^6
Driving force (measured 140 mm - *0.55 in* from pivot)
: 12 N *(2.7 lbf)*
Horizontal max. load . . . . . : 100 N *(22.5 lbf)*
Vertical max. load . . . . . : 1000 N *(225 lbf)*
Max. torque (vertical axis) . . . . . : 20 Nm *(4.5 lbf)*
Lever deflection . . . . . : ±20°
Center position tolerance . . . . . : ±2°

Proportional rocker

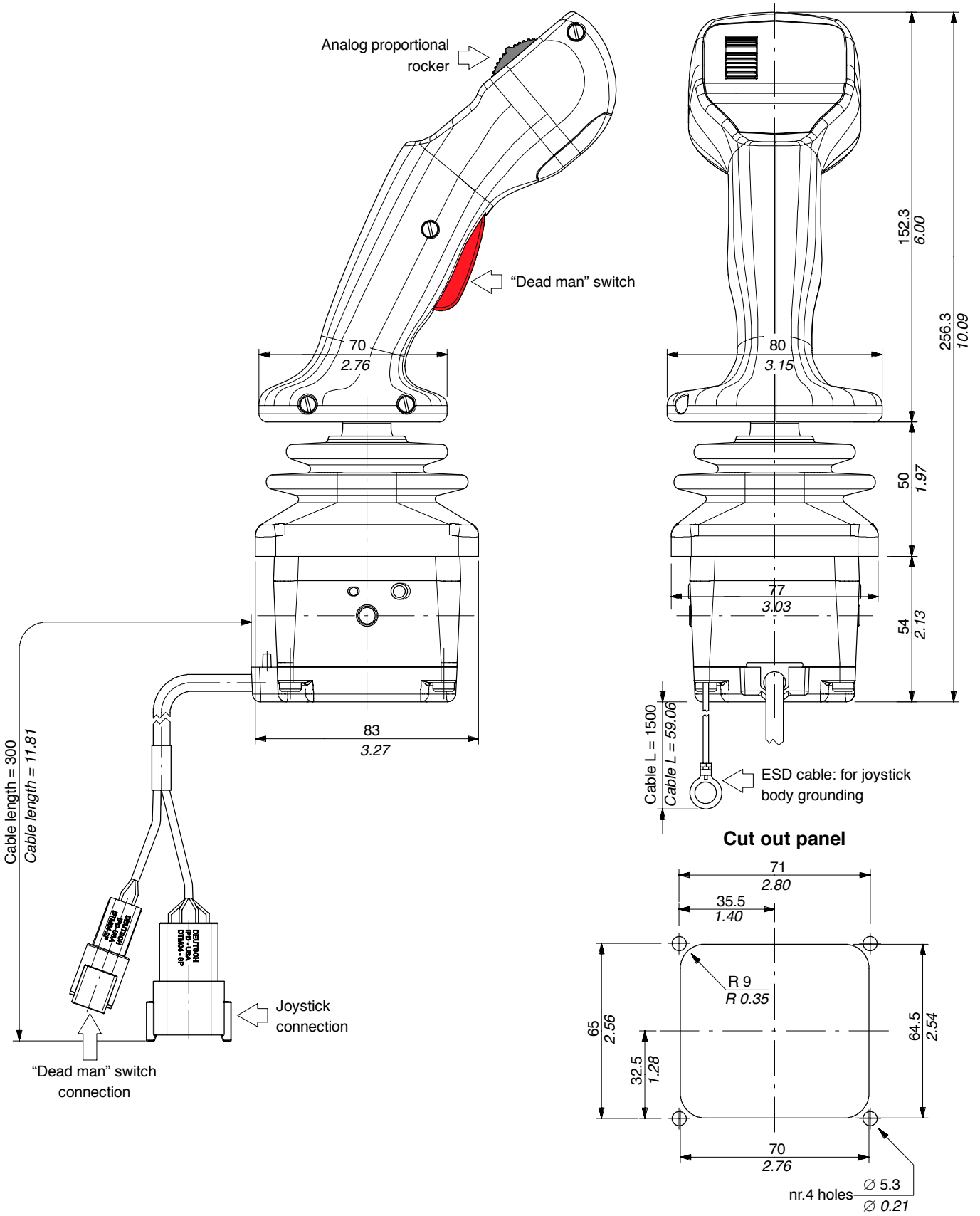
Output signal . . . . . : from 0.5 to 4.5 VDC
Mechanical life (n^r. of operations) . . : 2x10^6
Driving force . . . . . : from 4 to 6 N
(from 0.9 to 1.3 lbf)
Actuator deflection . . . . . : ± 30°

“Dead man” switch

Contact type . . . . . : normally open (NO)
Mechanical life (n^r. of operations) . . : 10^6
Electric life (n^r. of operations) . . . . . : 3x10^4

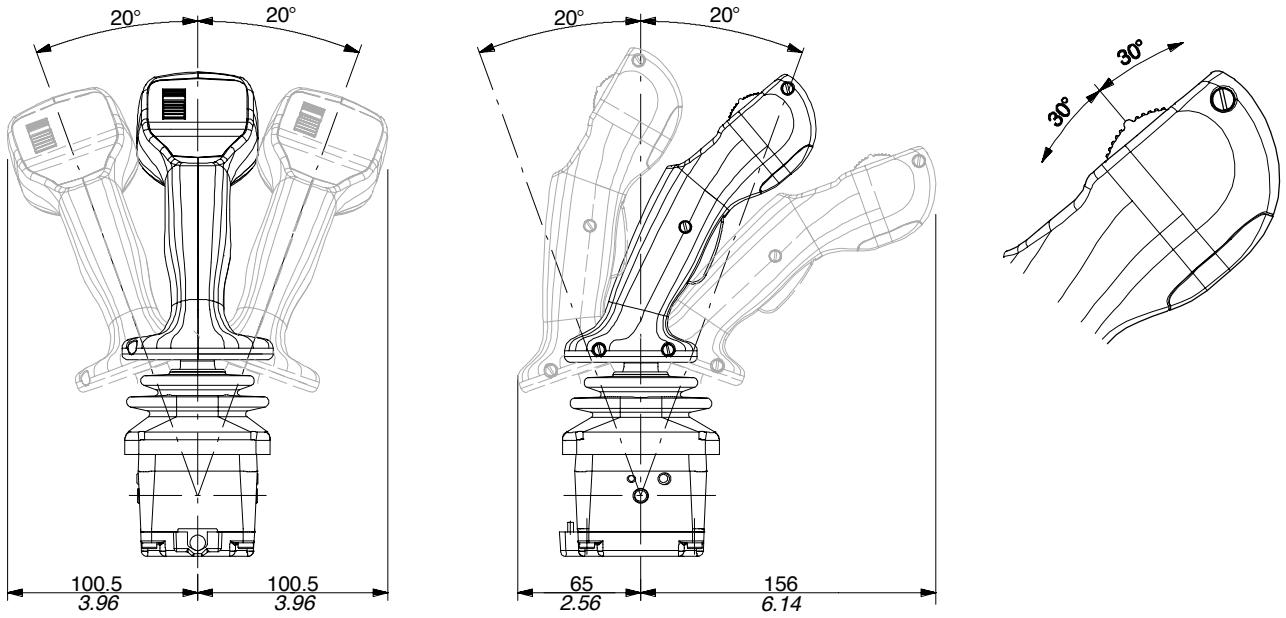
MDT219PZ joystick

Dimensions

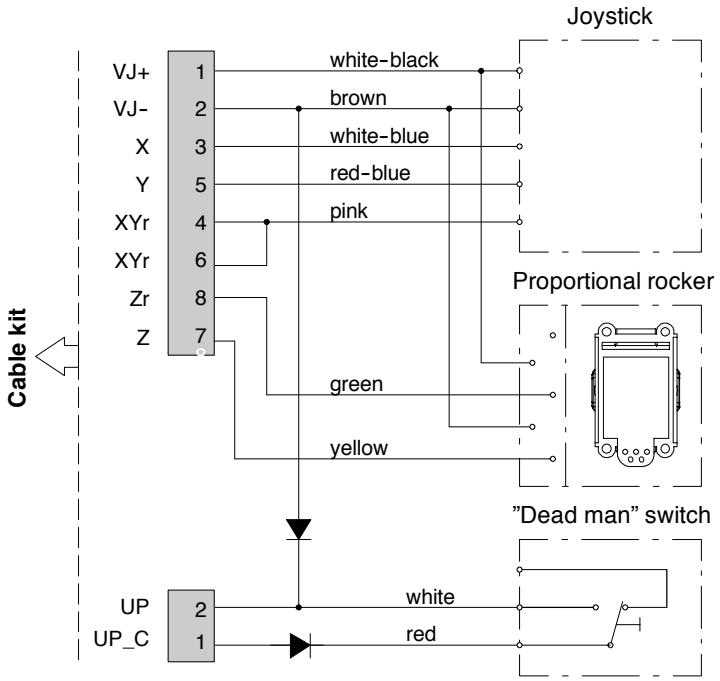


MDT219PZ joystick

Lever deflection angle



Electric circuit



JOYSTICK

Pin	Wire colour	Description
1	white-black	Supply + (VJ+)
2	brown	Supply - (VJ-)
3	white-blue	Proportional signal, X axis (X)
4	pink	Redundancy signal, X and Y axis (XYr)
5	red-blue	Proportional signal, Y axis (Y)
6	pink	Redundancy signal, X and Y axis (XYr

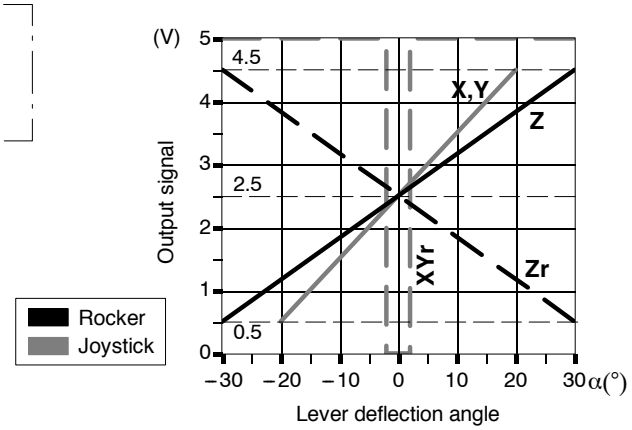
PROPORTIONAL ROCKER

7	yellow	Proportional signal, Z axis (Z)
8	green	Redundancy signal, Z axis (Zr)

"DEAD MAN" SWITCH

Pin	Wire colour	Description
1	red	Common microswitch (UP_C)
2	white	Microswitch NO contact (UP)

Output detail



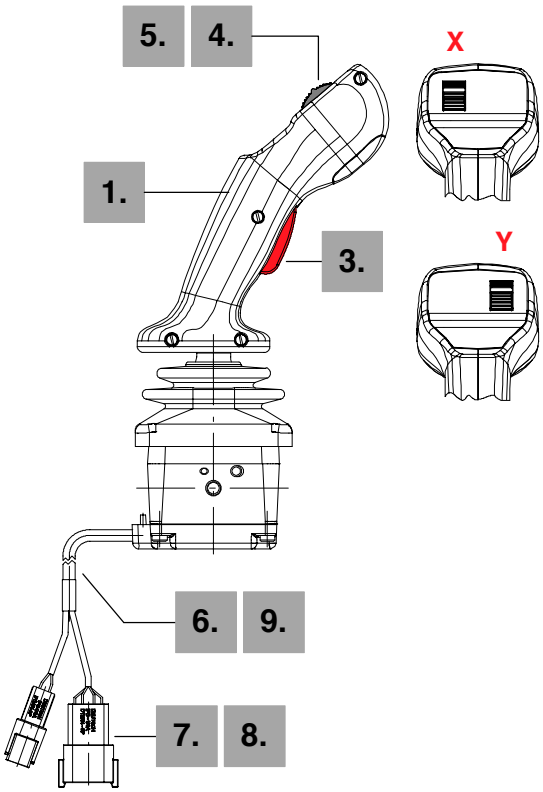
MDT219PZ joystick

Description example:

MDT219PZ A 0100A C - 0RD - X G3 / 01 D2 F 08 030 - 02 D2 F 02 030
+ ESD cable L=1.5

1. 2. 3. 4. 5. 6. 7. 8. 9.

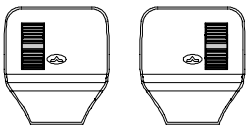
nr. of poles



1. Handle configuration

TYPE	DESCRIPTION
A	With “dead man” switch
B	Without “dead man” switch

2. Handle plate configuration



0100A **0100B**

3. “Dead man” switch

TYPE	DESCRIPTION
0RD	“Dead man” switch with red colour standard

4. Proportional rocker reference

TYPE	DESCRIPTION
X	Rocker placed on left
Y	Rocker placed on right

5. Proportional rocker actuator

TYPE	DESCRIPTION
G3	Knurled actuator
G4	Paddle actuator

6. Cable reference

TYPE	DESCRIPTION
01	Joystick connection
02	“Dead man” switch connection

7. Connector type

TYPE	DESCRIPTION
D2	“Deutsch DTM” connector

8. Connector coupling

TYPE	DESCRIPTION
F	Female connector with male ends

9. Cable length

TYPE	DESCRIPTION
050	Standard length 500 mm *(29.68 in):* the dimension is referred to cable total length and includes also the part inside the joystick

CED110 control unit

1 proportional function

Available for systems	
PHC100P■	PHC100F■
PHC200P□	PHC200F□
PHC300P□	PHC300F□

Description

The CED110 is the smallest unit of the PHC system range.
It allows precise control of system with single proportional function
An internal watch dog checks for software errors and will interrupt outputs if errors are detected.
All inputs are protected against EMI.

Technical data

General

Voltage supply range	from 8 to 16 VDC
Current absorption (stand by)	< 50 mA
Max. output current	2 A (@ 12 VDC)
Data interface	RS232, 9600, 8, n, 1
EMC compatibility	EN61000-4-2/4/5 ISO7637-0/1
Enviromental compatibility	IEC60068-2-6/27/29
Working temperature	from -35° to +85°C
Protection degree	IP 67
Weight	0.2 Kg *(0.44 lb)*

Analog inputs

Number	4
Signal range	n^{r}.2 from 0 to 30 VDC n^{r}.2 from 0 to 5 VDC

Digital inputs

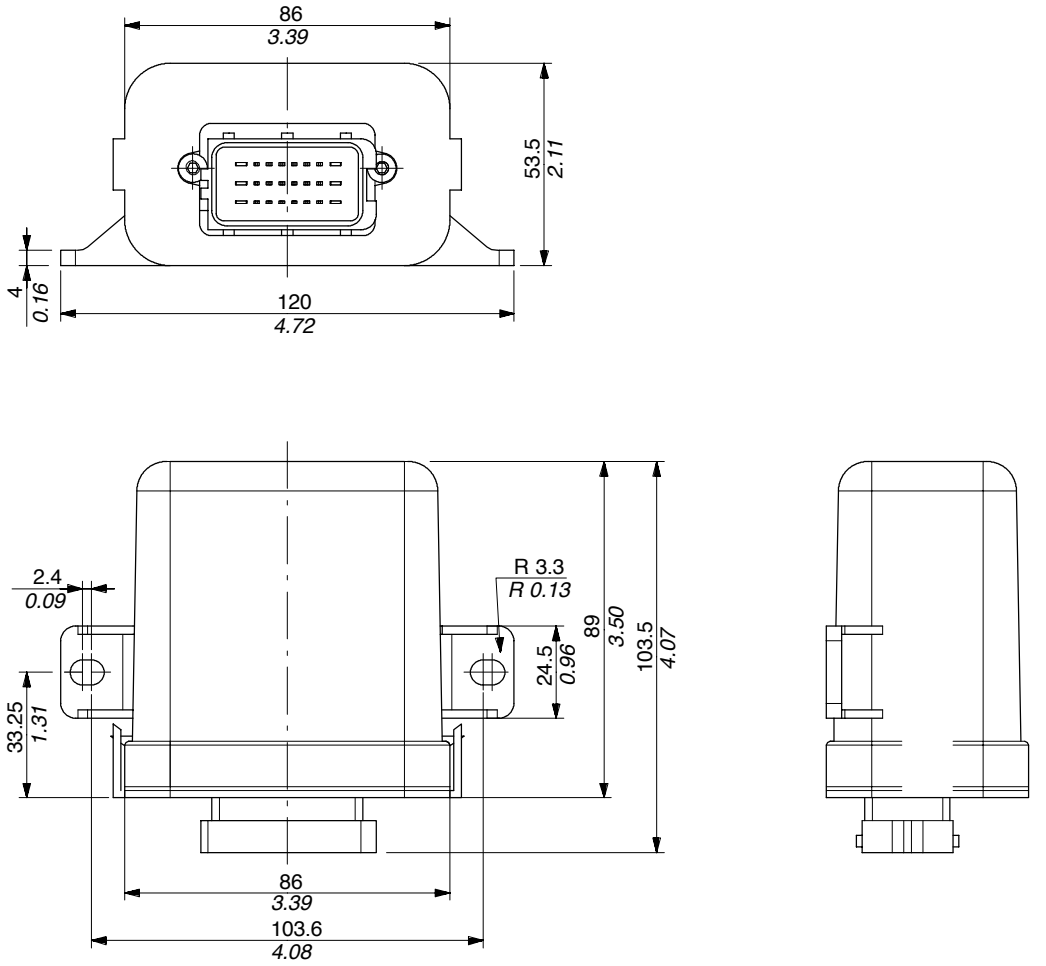
Number	1
Signal range	from 0 to 30 VDC

Proportional outputs

Numbers	2
Signal type	PWM
Frequency	100-150-220 Hz
Max. load current	2 A

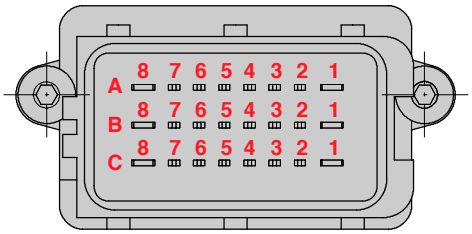
CED110 control unit

Dimensions



CED110 control unit

Pin-out



24 poles connector pin-out - familiy P

Pin	Description	Pin	Description	Pin	Description
A1	---------	**B1**	Battery supply VB+	**C1**	Battery supply VB- (GND)
A2	Output PWM 1B+	**B2**	Output PWM 1A+	**C2**	Output PWM 1A-, 1B-
A3	Input Dead Man UP	**B3**	---------	**C3**	---------
A4	Input joystick X	**B4**	---------	**C4**	Joystick GND VJ-
A5	Input joystick Xr	**B5**	---------	**C5**	---------
A6	---------	**B6**	---------	**C6**	---------
A7	---------	**B7**	---------	**C7**	---------
A8	RS232 TX	**B8**	RS232 RX	**C8**	RS232 GND

24 poles connector pin-out - familiy F

Pin	Description	Pin	Description	Pin	Description
A1	---------	**B1**	Battery supply VB+	**C1**	Battery supply VB- (GND)
A2	Output PWM 1B+	**B2**	Output PWM 1A+	**C2**	Output PWM 1A-, 1B-
A3	Input Dead Man UP	**B3**	---------	**C3**	---------
A4	---------	**B4**	Input signal X	**C4**	Joystick GND VJ-
A5	---------	**B5**	Input signal Xr	**C5**	---------
A6	---------	**B6**	---------	**C6**	---------
A7	---------	**B7**	---------	**C7**	---------
A8	RS232 TX	**B8**	RS232 RX	**C8**	RS232 GND

Description example

CED110 / WALVOIL / PHC100P / v100.01

1. **2.**

1. System family

TYPE	DESCRIPTION
PHC100F	For system PHC100F
PHC100P	For system PHC100P

2. Programming software

TYPE	DESCRIPTION
v100.00	Standard programming software for PHC100F system
v100.01	Standard programming software for PHC100P system

CED251 control unit

2 ***proprotional function***

Available for systems	
PHC100P□	PHC100F□
PHC200P■	PHC200F■
PHC300P□	PHC300F□

Description

When precise and careful control of two proportional functions are required, the CED251 is the answer.
An internal watch dog checks for software errors and will interrupt outputs if errors are detected.
All inputs are protected against EMI and voltage transient.
The Personal Computer direct interfaceability and complete programming trough WST (Walvoil Service Tool), makes the CED251 extremely versatile and adattibile to the most varied demands.

Technical data

General

Voltage supply range	from 8 to 16 VDC
Current absorption (stand by)	< 150 mA
Max. output current	4 A (@ 12 VDC)
Data interface	RS232, 9600, 8, n, 1
EMC compatibility	EN61000-4-2/4/5 ISO7637-0/1
Enviromental compatibility	IEC60068-2-6/27/29
Working conditions	from -35° to +85°C
Protection degree	IP 67
Weight	0.8 Kg *(1.76 lb)*

Analog inputs

Number	4
Signal range	n^{r}.2 from 0 to 30 VDC n^{r}.2 from 0 to 5 VDC

Digital inputs

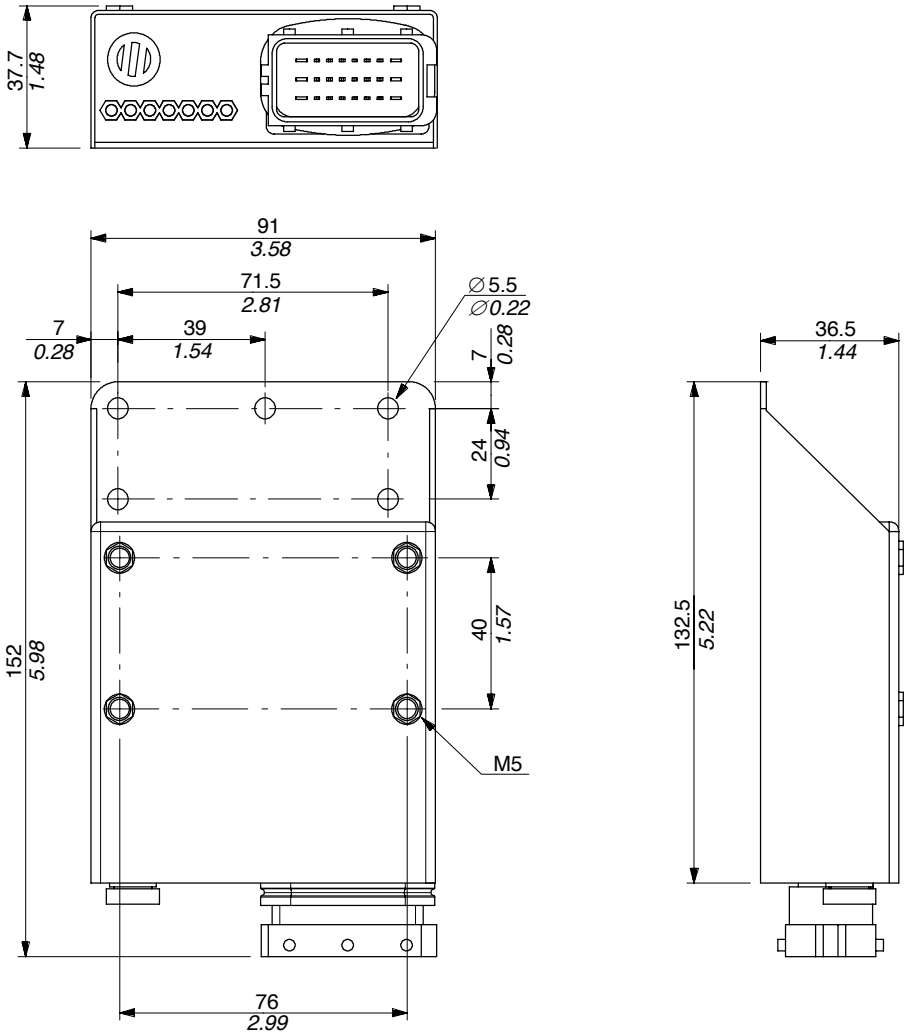
Number	1
Signal	from 0 to 30 VDC

Proportional outputs

Number	4
Signal type	PWM
Frequency	100-150-220 Hz
Max. load current	2 A

CED251 control unit

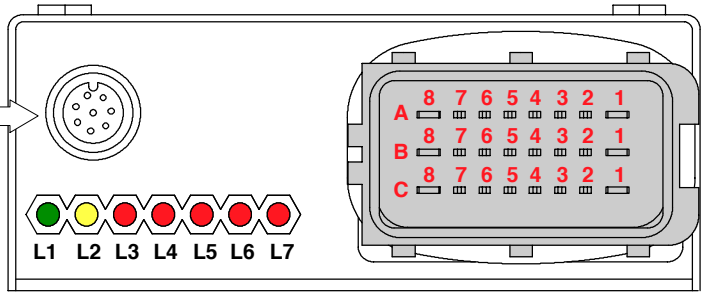
Dimensions



CED251 control unit

Pin-out

8 poles connector for programming: for cable see page 78



24 poles connector pin-out - familiy P

Pin	Description	Pin	Description	Pin	Description
A1	Input GND VJ-	**B1**	---------	**C1**	---------
A2	Signal X input	**B2**	Output PWM 1B+	**C2**	---------
A3	Signal Y input	**B3**	---------	**C3**	---------
A4	Signal Xr input	**B4**	Output PWM 2A+	**C4**	---------
A5	Signal Yr input	**B5**	Output PWM 2A-, 2B-	**C5**	Input Dead Man UP
A6	Output PWM 1A+	**B6**	Output PWM 2B+	**C6**	---------
A7	Output PWM 1A-, 1B-	**B7**	---------	**C7**	---------
A8	Battery supply VB+	**B8**	---------	**C8**	Battery supply VB- (GND)

8 poles connector pin-out

Pin	Description
C1	---------
C2	RS232 TX
C3	RS232 RX
C4	---------
C5	RS232 GND
C6	---------
C7	---------
C8	---------

24 poles connector pin-out - familiy F

Pin	Description	Pin	Description	Pin	Description
A1	Joystick GND VJ-	**B1**	---------	**C1**	---------
A2	Signal Xr input	**B2**	Output PWM 1B+	**C2**	---------
A3	Signal Yr input	**B3**	---------	**C3**	---------
A4	Signal X input	**B4**	Output PWM 2A+	**C4**	---------
A5	Signal Y input	**B5**	Output PWM 2A-, 2B-	**C5**	Input Dead Man UP
A6	Output PWM 1A+	**B6**	Output PWM 2B+	**C6**	---------
A7	Output PWM 1A-, 1B-	**B7**	---------	**C7**	---------
A8	Battery supply VB+	**B8**	---------	**C8**	Battery supply VB- (GND)

LED list

Pin	Description
L1	Battery supply VB+ (green)
L2	Relay VB+ ON (yellow)
L3	Output PWM 1A ON (red)
L4	Output PWM 1B ON (red)
L5	Output PWM 2A ON (red)
L6	Output PWM 2B ON (red)
L7	Input UP ON (red)

Description example

CED251 / WALVOIL / PHC200P / v200.01

1. 2.

1. System family

TYPE	DESCRIPTION
PHC200F	For system PHC200F
PHC200P	For system PHC200P

2. Programming software

TYPE	DESCRIPTION
v200.00	Standard programming software for PHC200F system
v200.01	Standard programming software for PHC200P system

CED252 control unit

3 *proportional functions*

Available for systems	
PHC100P□	PHC100F□
PHC200P□	PHC200F□
PHC300P■	PHC300F■

Description

It's the most compete control unit in the PHC systems range. The aluminium construction which ensures sturdiness and lightness and the special anti-condensate device, make it ideal for heavy duty applications in adverse environmental conditions.
An internal watch dog checks for software errors and will interrupt outputs if errors are detected.
All inputs are protected against EMI and voltage transient.
CED252 is extremely versatile unit and it's configurable trough Personal Computer and WST (Walvoil Service Tool) programming software.

Technical data

General

Voltage supply range	from 8 to 16 VDC
Current absorption (stand by)	< 100 mA
Max. output current	6 A (@ 12 VDC)
Data interface	RS232, 9600, 8, n, 1
EMC compatibility	EN61000-4-2/4/5
	ISO7637-0/1
	2000/2/EC
	CE
Enviromental compatibility	IEC60068-2-6/27/29
Working temperature	from -35° to +85°C
Protection degree	IP 67
Weight	0.8 Kg

Analog inputs

Number	6
Siganl range	n^r.3 from 0 to 30 VDC
	n^r.3 from 0 to 5 VDC

Digital inputs

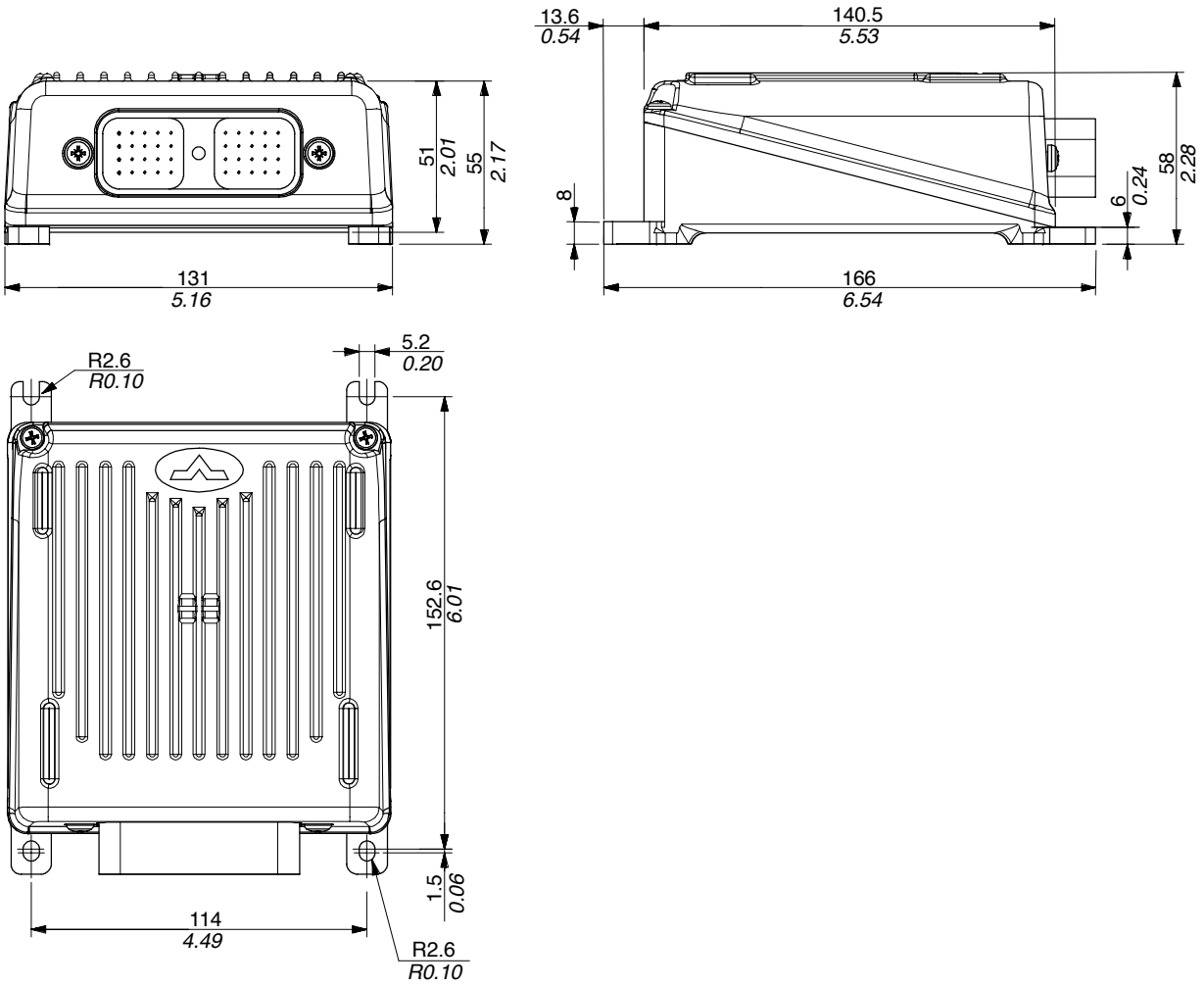
Number	1
Signal range	from 0 to 30 VDC

Proportional outputs

Number	6
Signal type	PWM
Frequency	100-150-220 Hz
Max. load current	2 A

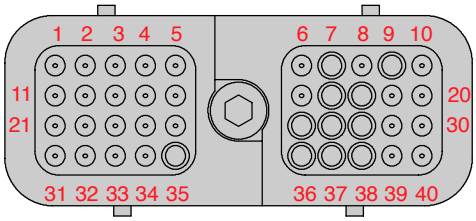
CED252 control unit

Dimensions



CED252 control unit

Pin-out



40 poles connector pin-out - familiy P

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Output PWM 3A+	11	Output PWM 2B+	21	Output PWM 1A+	31	Output PWM 2A+
2	Output PWM 3B+	12	---------	22	---------	32	---------
3	---------	13	Output PWM 1A-, 1B-	23	Output PWM 1B+	33	---------
4	Key supply VK+	14	Joystick supply VJ+	24	Output PWM 2A-, 2B-	34	Joystick supply VJ+
5	Output PWM 3A-, 3B-	15	Battery supply VB+	25	Input Dead Man UP	35	---------
6	Battery supply VB- (GND)	16	Joystick GND VJ-	26	Signal Zr input	36	---------
7	---------	17	---------	27	Signal Y input	37	---------
8	Signal X input	18	Signal Xr input	28	---------	38	Signal Yr input
9	Signal Z input	19	RS232 GND	29	RS232 RX	39	RS232 TX
10	---------	20	---------	30	---------	40	---------

40 poles connector pin-out - familiy F

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	Output PWM 3A+	11	Output PWM 2B+	21	Output PWM 1A+	31	Output PWM 2A+
2	Output PWM 3B+	12	---------	22	---------	32	---------
3	---------	13	Output PWM 1A-, 1B-	23	Output PWM 1B+	33	---------
4	Key supply VK+	14	Joystick supply VJ+	24	Output PWM 2A-, 2B-	34	Joystick supply VJ+
5	Output PWM 3A-, 3B-	15	Battery supply VB+	25	Input Dead Man UP	35	---------
6	Battery supply VB- (GND)	16	Joystick GND VJ-	26	---------	36	Signal X input
7	Signal Y input	17	Signal Xr input	27	---------	37	Signal Z input
8	Signal Zr input	18	---------	28	Signal Yr input	38	---------
9	---------	19	RS232 GND	29	RS232 RX	39	RS232 TX
10	---------	20	---------	30	---------	40	---------

Description example

CED252 / WALVOIL / PHC300P / v300.01

1. **2.**

1. System family

TYPE	DESCRIPTION
PHC300F	For system PHC300F
PHC300P	For system PHC300P

2. Programming software

TYPE	DESCRIPTION
v300.00	Standard programming software for PHC300F system
v300.01	Standard programming software for PHC300P system

KCD cable kit

Description

It's a system harness for the application in the automotive, agricultural and civil sectors and it combine low cost, manufacturing easinesses, excellent mechanical features and protection features against the corrosive agents (as hydraulic oil, fuels, manures and fertilizers).
The single wires have PVC isolation class R3, in compliance with the specifications Fiat Tab 91107/13 for cables in thermal class T2 (up to +105°C), and they are tested according to test specifications 9/91107 and 7/Z8220.
The wrinkled pipe increases the mechanical sturdiness, and protects the wires in the most difficult environmental situations.

Technical data

General

Working temperature	: from -30° C to +105° C
Job features	: fixed laying, motor, agricultural and civil environment
Electrical insulation	
rule	: CEI 20-11 tipo R3
directive	: 2000/53/CE
Conductor section	: DIN 72551-6 type A and B
Max. load current (continuative)	
0.35 mm^2 *(5.4x10^{-4} in^2)*	: up to 1 A
0.5 mm^2 *(8x10^{-4} in^2)*	: up to 2.5 A
1 mm^2 *(1.6x10^{-3} in^2)*	: up to 5 A
1.5 mm^2 *(2.3x10^{-3} in^2)*	: fino a 10 A

Connectors

Towards control unit	
PHC100 e PHC200	: tin plated contacts
PHC300	: gold plated contacts
Towards joystick	: gold plated contacts
Towards solenoid valves	: tin plated contacts
RS232 programming connector	: tin plated contacts

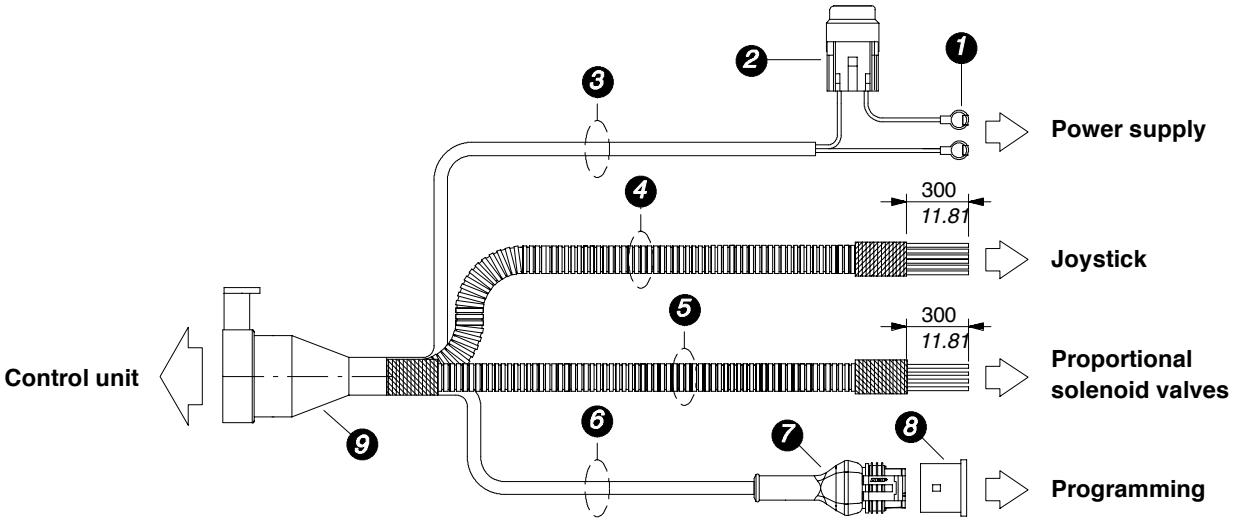
KCD100P cable kit

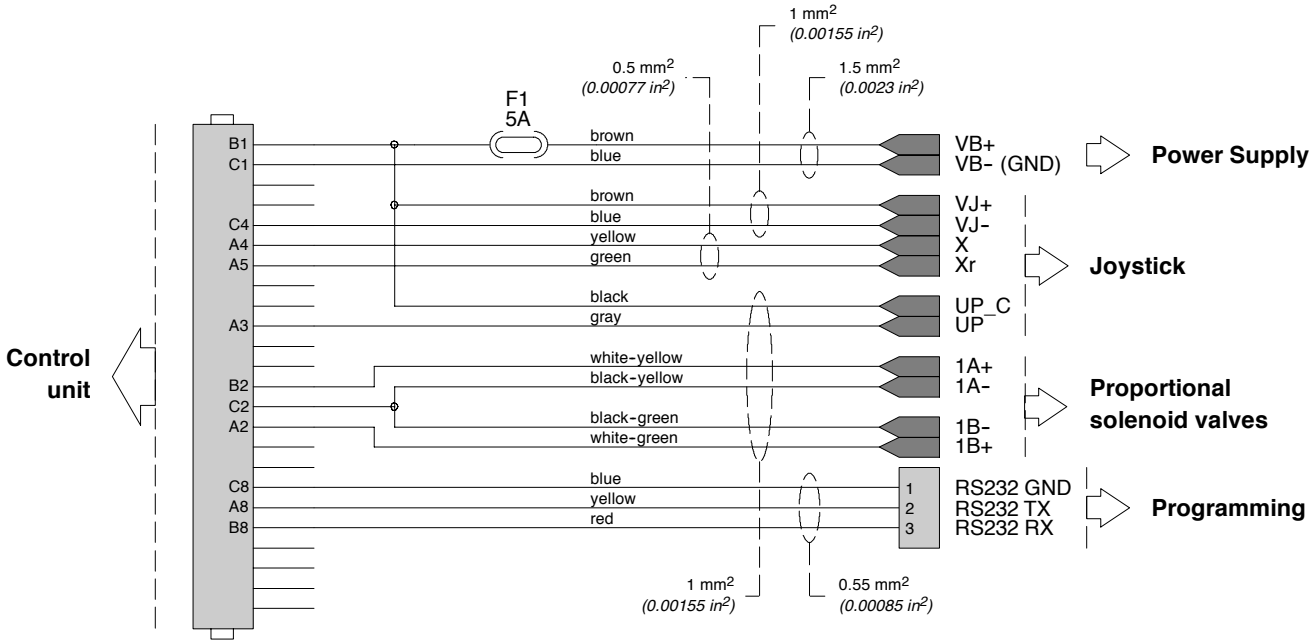
1 ***proportional function***

Available for systems	
PHC100P■	PHC100F□
PHC200P□	PHC200F□
PHC300P□	PHC300F□

List

1) Eyelet ∅ 10mm (*0.39 in*)
2) Fuseholder with DIN72581 - 19x20 mm - 5 A fuse
3) Cable 2x1.5 mm^2 (*2x0.0023 in^2*)
4) Wrinkled pipe ∅ 13 mm (*0.51 in*) + n^r.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm^2 (*0.00155 in^2*) + n^r.2 wires ∅ 1.7 mm (*0.067 in*) section 0.5 mm^2 (*0.00077 in^2*)
5) Wrinkled pipe ∅ 9 mm (*0.35 in*) + n^r.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm^2 (*0.00155 in^2*)
6) 3 poles cable 3x0.55 mm^2 (*3x0.00085 in^2*)
7) 3 poles male "AMP Superseal 1.5" connector with rubber boot
8) Connector plug
9) 24 poles "Framatome Sicma" connector





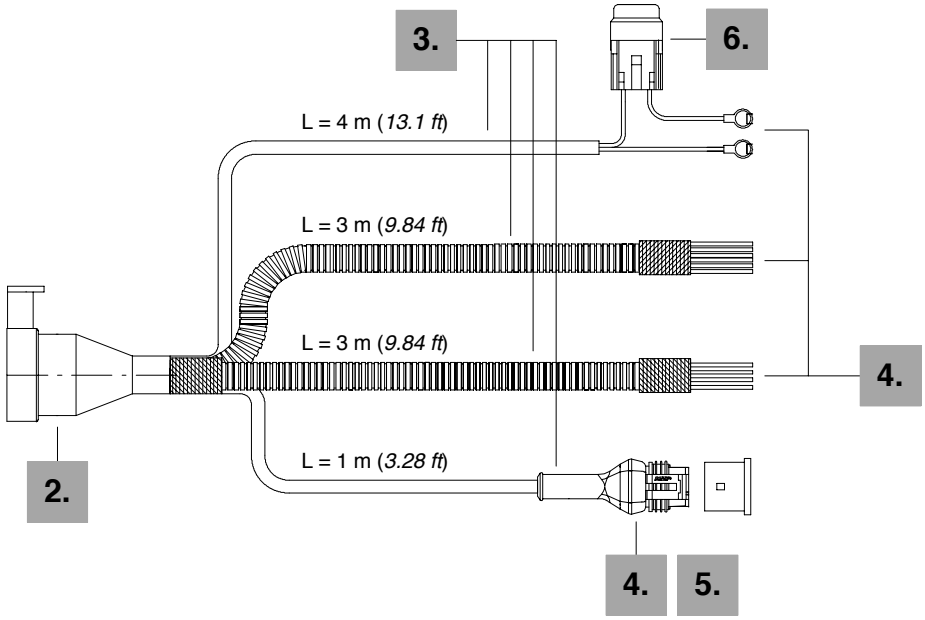
KCD100P cable kit

Description example

KCD P 04 / CSIF 24 - 01 O2 300 (TC) - 03O2300(TC) - 09 A1 M 03 100 (TAP)

- 1. — P: P type PHC system
- 04: Nr. of cables
- 2. — CSIF: Multipolar female "Framatome Sicma" connector
- 24: Nr. of poles
- 3. — 01: Proportional control device connection
- 4. — O2: With flying leads
- 300: Cable length in cm
- (TC): Wrinkled pipe
- 03O2300(TC): Proportional solenoid valves connection, With flying leads, Cable length in cm, Wrinkled pipe
- 3. — 09: RS232 programming cable
- 4. — A1: With "AMP Superseal" connector
- 5. — M: Male type
- 03: Nr. of poles
- 100: Cable length in cm
- (TAP): Connector plugged

- 3. — A: Power supply cable
- 4. — U1: With eyelet
- 6. — F05: Fuseholder with 5A fuse
- 400: Cable length in cm



1. System family

TYPE	DESCRIPTION
P	For P type PHC system

2. Main connector

TYPE	DESCRIPTION
CSIF	Multipolar female "Framatome Sicma" connector

3. Cables numeration

TYPE	DESCRIPTION
01	Proportional control device connection
03	Proportional solenoid valves connection
09	RS232 programming cable
A	Power supply cable

4. Connection type

TYPE	DESCRIPTION
A1	With "AMP Superseal" connector
O2	With flying leads
U1	With eyelet

5. Connector coupling

TYPE	DESCRIPTION
M	Male type

6. Power supply protection

TYPE	DESCRIPTION
F05	Fuseholder with 5A fuse

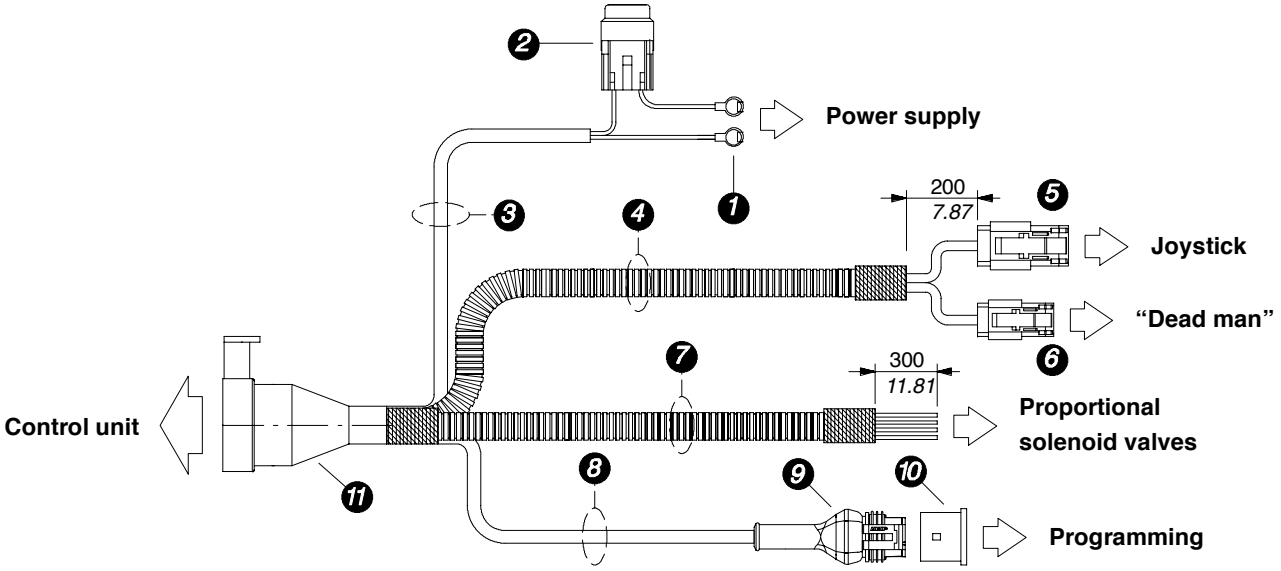
KCD100F cable kit

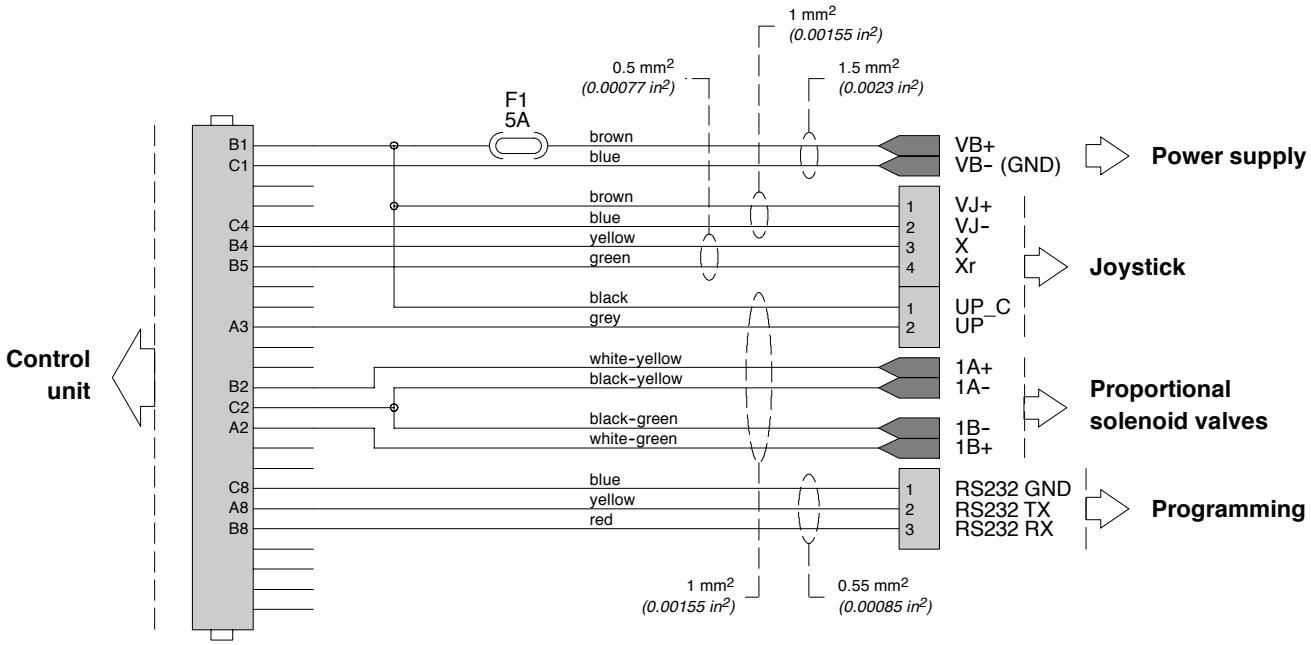
1 *proportional function*

Available for systems	
PHC100P☐	PHC100F■
PHC200P☐	PHC200F☐
PHC300P☐	PHC300F☐

List

1) Eyelet ∅ 10mm (*0.39 in*)
2) Fuseholder with DIN72581 - 19x20 mm - 5 A fuse
3) Cable 2x1.5 mm² (*2x0.0023 in²*)
4) Wrinkled pipe ∅ 13 mm (*0.51 in*) + nr.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm² (*0.00155 in²*) + nr.2 wires ∅ 1.7 mm (*0.067 in*) section 0.5 mm² (*0.00077 in²*)
5) 4 poles "Deutsch DTM06-4S" male connector
6) 2 poles "Deutsch DTM06-2S" male connector
7) Wrinkled pipe ∅ 9 mm (*0.35 in*) + nr.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm² (*0.00155 in²*)
8) 3 poles cable 3x0.55 mm² (*3x0.00085 in²*)
9) 3 poles male "AMP Superseal 1.5" connector with rubber boot
10) Connector plug
11) 24 poles "Framatome Sicma" connector





KCD100F cable kit

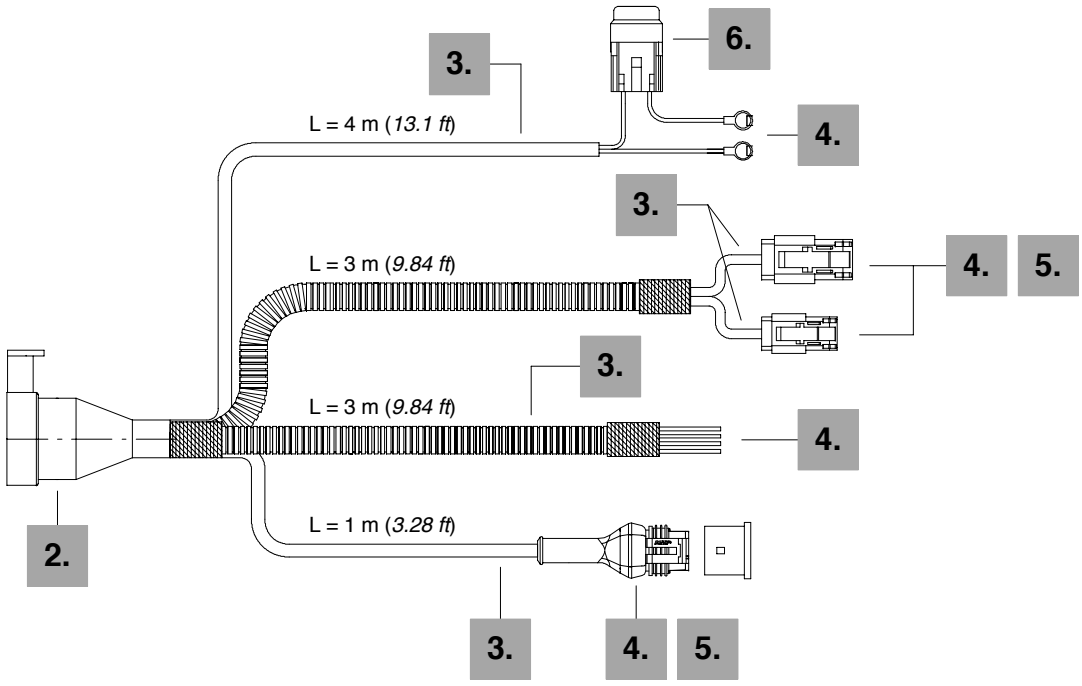
Description example

KCD F 05 / CSIF 24 - 01 D2 M 04 300 (TC) - 02D2M02300(TC) - 03 O2 300 (TC)

- 1. Nr. of cables
- 2. Nr. of poles
- 3. Nr. of poles
- 4. Cable length in cm
- 3. Cable length in cm
- 4. Wrinkled pipe

- 09A1M03100 (TAP) - A U1 F05 400

- Connector plugged
- 3.
- 4.
- 6. Cable length in cm



1. System family

TYPE	DESCRIPTION
F	For F type PHC system

2. Main connector

TYPE	DESCRIPTION
CSIF	Multipolar female “Framatome Sicma” connector

3. Cables numeration

TYPE	DESCRIPTION
01	Proportional control device connection
02	“Dead man” connection
03	Proportional solenoid valves connection
09	RS232 programming cable
A	Power supply cable

4. Connection type

TYPE	DESCRIPTION
A1	With “AMP Superseal” connector
D2	With “Deutsch DTM” connector
O2	With flying leads
U1	With eyelet

5. Connector coupling

TYPE	DESCRIPTION
M	Male type

6. Supply protection

TYPE	DESCRIPTION
F05	Fuseholder with 5A fuse

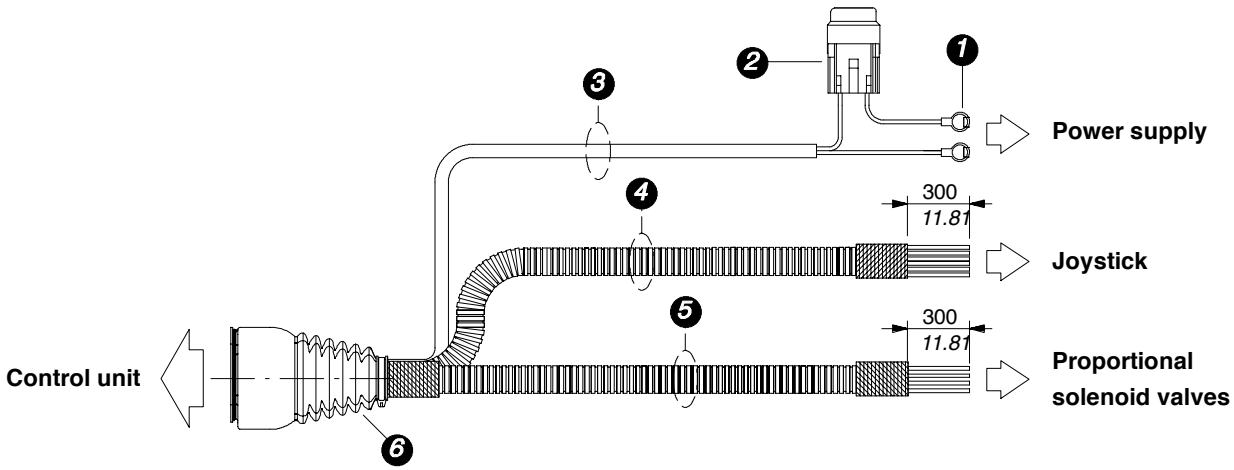
KCD200P cable kit

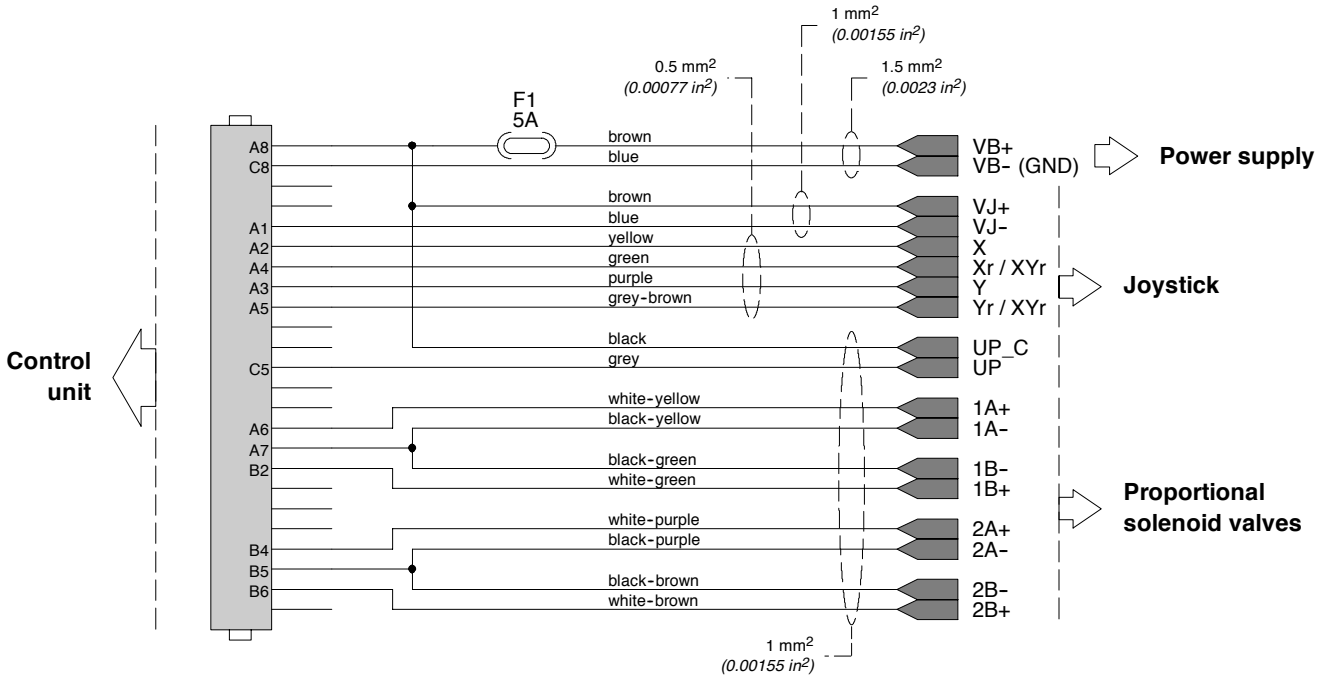
2 ***proportional functions***

Available for systems	
PHC100P☐	PHC100F☐
PHC200P■	PHC200F☐
PHC300P☐	PHC300F☐

List

1) Eyelet ∅ 10mm (*0.39 in*)
2) Fuseholder with DIN72581 - 19x20 mm - 5 A fuse
3) Cable 2x1.5 mm^2 (*2x0.0023 in^2*)
4) Wrinkled pipe ∅ 13 mm (*0.51 in*) + n^r.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm^2 (*0.00155 in^2*) + n^r.4 wires ∅ 1.7 mm (*0.067 in*) section 0.5 mm^2 (*0.00077 in^2*)
5) Wrinkled pipe ∅ 13 mm (*0.51 in*) + n^r.8 wires ∅ 2.1 mm (*0.083 in*) section 1 mm^2 (*0.00155 in^2*)
6) 24 poles "Framatome Sicma" connector with rubber boot





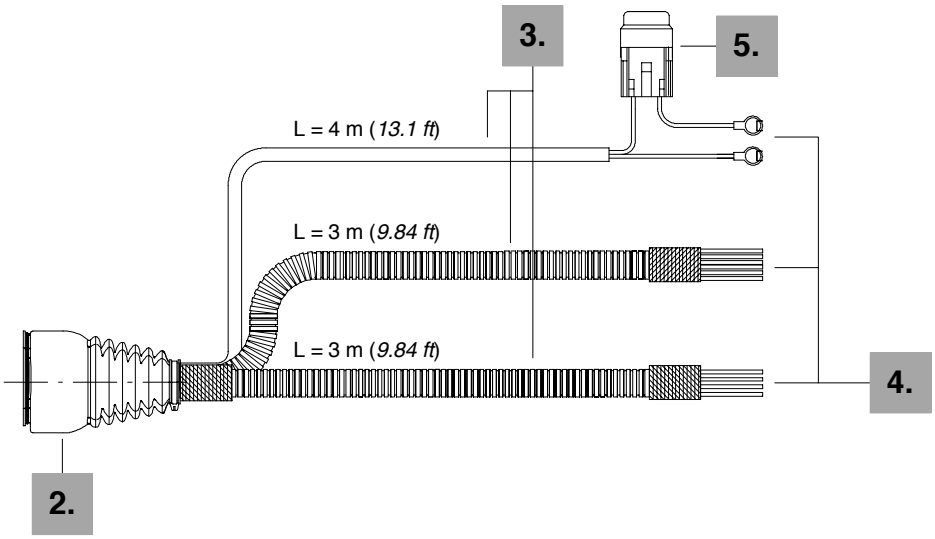
KCD200P cable kit

Description example

KCD P 03 / CSIF 24 - 01 O2 300 (TC) - 03O2300(TC) - A U1 F05 400

1. KCD P
2. CSIF 24
3. 01
4. O2 300 (TC)
3. A
4. U1
5. F05 400

Nr. of cables
Nr. of poles
Cable length in cm
Wrinkled pipe
Cable length in cm



1. System family

TYPE	DESCRIPTION
P	For P type PHC system

2. Main connector

TYPE	DESCRIPTION
CSIF	Multipolar female “Framatome Sicma” connector

3. Cables numeration

TYPE	DESCRIPTION
01	Proportional control device connection
03	Proportional solenoid valves connection
A	Supply cable

4. Connection type

TYPE	DESCRIPTION
O2	With flying leads
U1	With eyelet

5. Supply protection

TYPE	DESCRIPTION
F05	Fuseholder with 5A fuse

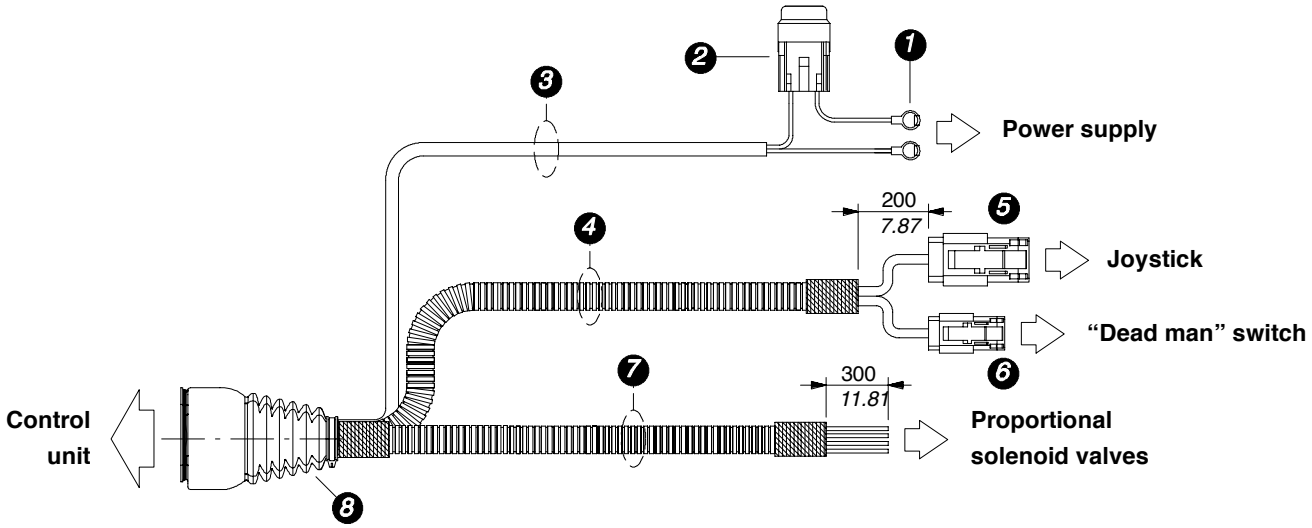
KCD200F cable kit

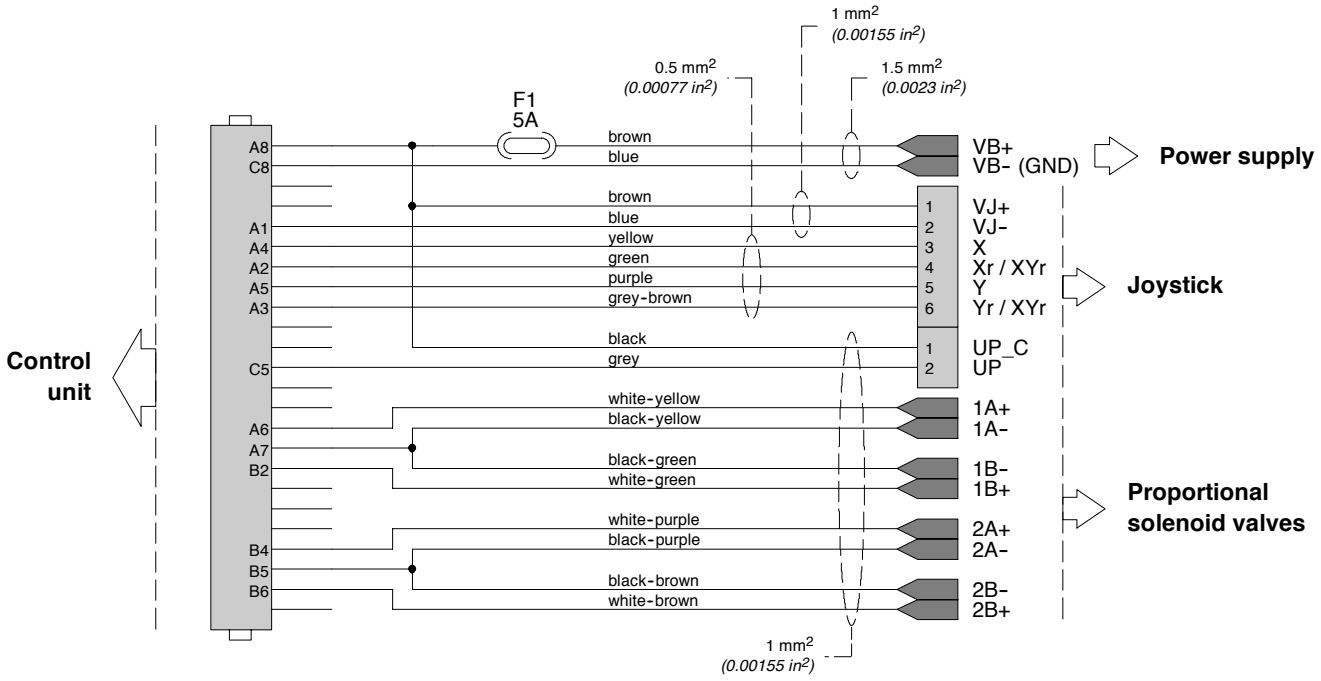
2 *proportional functions*

Available for systems	
PHC100P☐	PHC100F☐
PHC200P☐	PHC200F■
PHC300P☐	PHC300F☐

List

1) Eyelet ∅ 10mm (*0.39 in*)
2) Fuseholder with DIN72581 - 19x20 mm - 5 A fuse
3) Cable 2x1.5 mm^2 (*2x0.0023 in^2*)
4) Wrinkled pipe ∅ 13 mm (*0.51 in*) + n^r.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm^2 (*0.00155 in^2*) + n^r.4 wires ∅ 1.7 mm (*0.067 in*) section 0.5 mm^2 (*0.00077 in^2*)
5) 6 poles “Deutsch DTM06-6S” male connector
6) 2 poles “Deutsch DTM06-2S” male connector
7) Wrinkled pipe ∅ 13 mm (*0.51 in*) + n^r.8 wires ∅ 2.1 mm (*0.083 in*) section 1 mm^2 (*0.00155 in^2*)
8) 24 poles “Framatome Sicma” connector with rubber boot





KCD200F cable kit

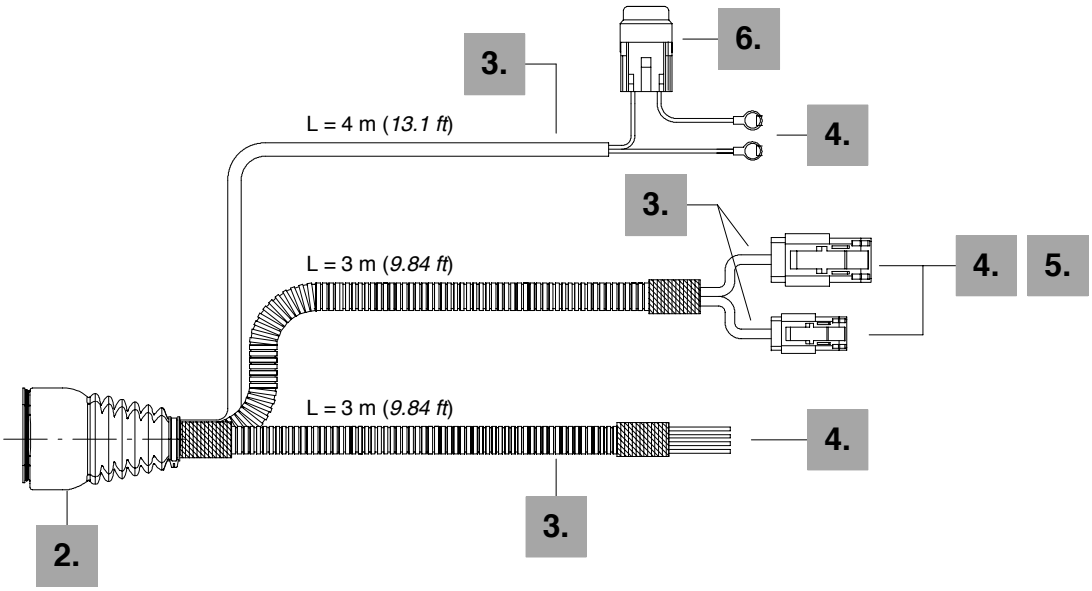
Description example

KCD F 04 / CSIF 24 - 01 D2 M 06 300 (TC) - 02D2M02300(TC) - 03 O2 300 (TC)

1. Nr. of cables
2. Nr. of poles
3. Nr. of poles
4. 5. Cable length in cm
Wrinkled pipe
3. 4. Cable length in cm
Wrinkled pipe

- A U1 F05 400

3. 4. 6. Cable length in cm



1. System family

TYPE	DESCRIPTION
F	For F type PHC system

2. Main connector

TYPE	DESCRIPTION
CSIF	Multipolar female “Framatome Sicma” connector

3. Cables numeration

TYPE	DESCRIPTION
01	Proportional control device connection
02	“Dead man” connection
03	Proportional solenoid valves connection
A	Power supply cable

4. Connection type

TYPE	DESCRIPTION
D2	With “Deutsch DTM” connector
O2	With flying leads
U1	With eyelet

5. Connector coupling

TYPE	DESCRIPTION
M	Male type

6. Power supply protection

TYPE	DESCRIPTION
F05	Fuseholder with 5A fuse

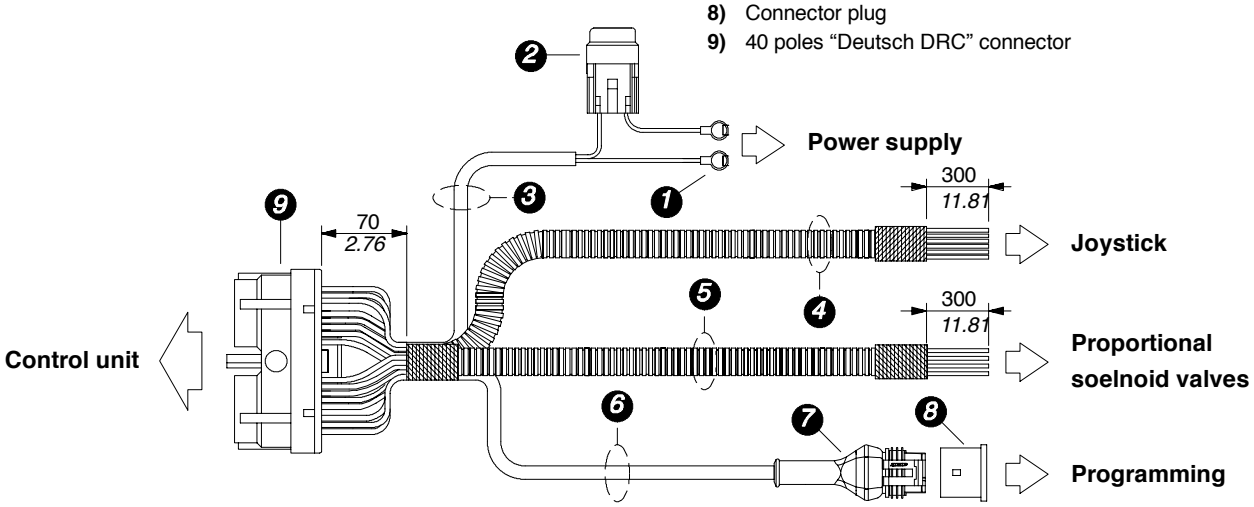
Kit cavi KCD300P

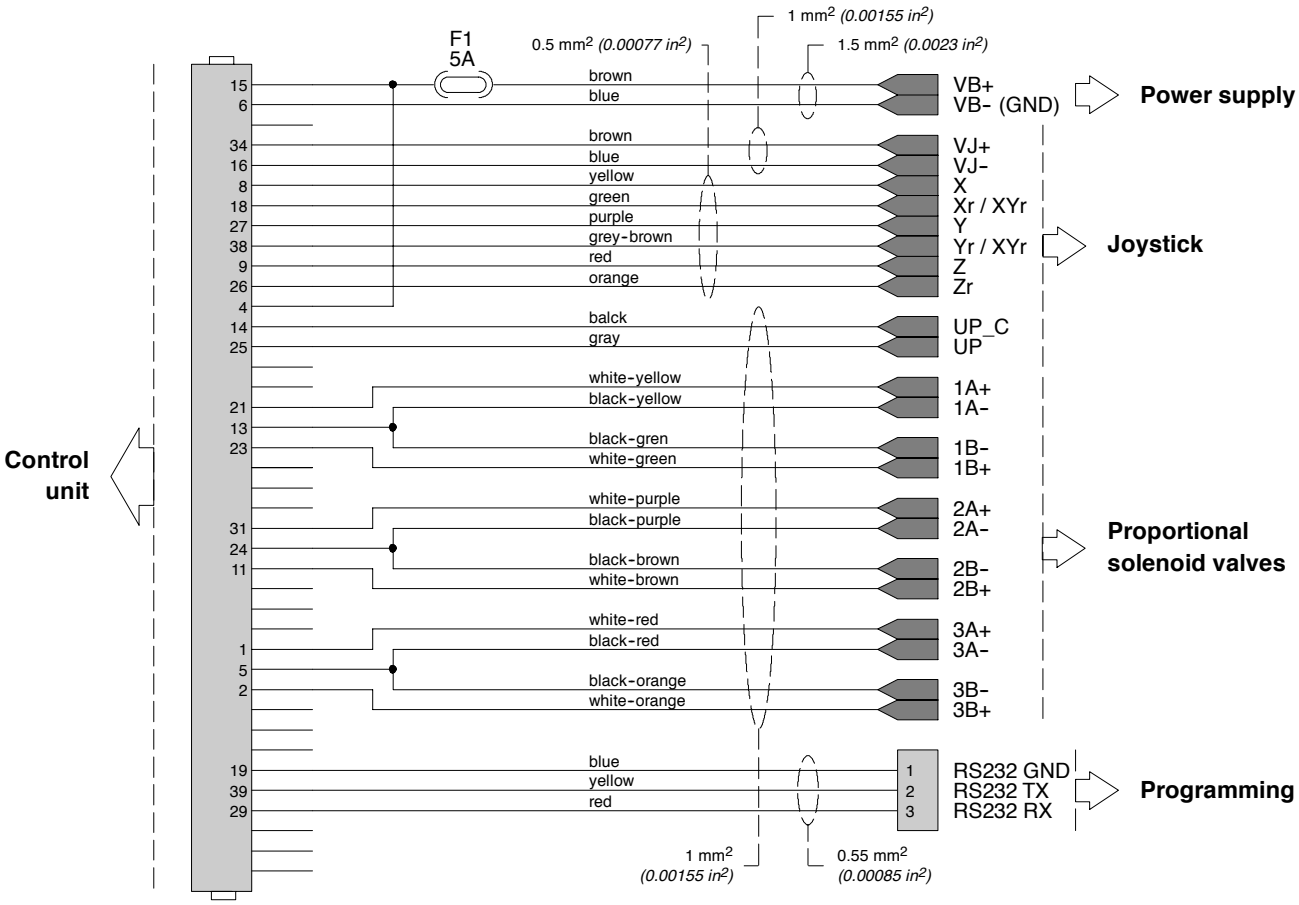
3 *proportional functions*

Available for systems	
PHC100P☐	PHC100F☐
PHC200P☐	PHC200F☐
PHC300P■	PHC300F☐

List

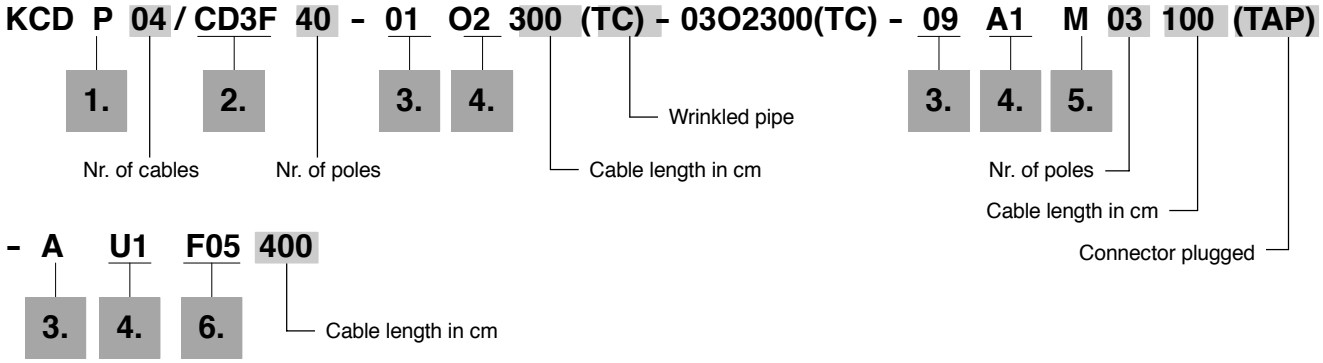
1) Eyelet ∅ 10 mm (*0.39 in*)
2) Fuseholder with DIN72581 - 19x20 mm - 5 A fuse
3) Cable 2x1.5 mm² (*2x0.0023 in²*)
4) Wrinkled pipe ∅ 16 mm (*0.63 in*) + nr.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm² (*0.00155 in²*) + nr.6 wires ∅ 1.7 mm (*0.067 in*) section 0.5 mm² (*0.00077 in²*)
5) Wrinkled pipe ∅ 16 mm (*0.63 in*) + nr.12 wires ∅ 2.1 mm (*0.083 in*) section 1 mm² (*0.00155 in²*)
6) 3 poles cable 3x0.55 mm² (*3x0.00085 in²*)
7) 3 poles male "AMP Superseal 1.5" connector with rubber boot
8) Connector plug
9) 40 poles "Deutsch DRC" connector

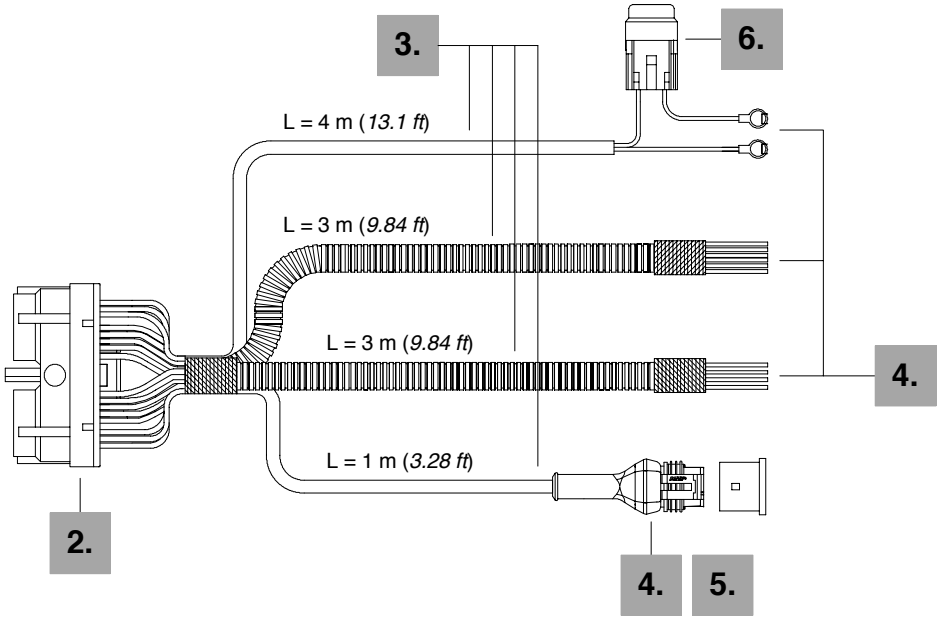




KCD300P cable kit

Description example





1. System family

TYPE	DESCRIPTION
P	For P type PHC system

2. Connettore principale

TYPE	DESCRIPTION
CD3F	Multipolar female “Deutsch DRC” connector

3. Cables numeration

TYPE	DESCRIPTION
01	Proportional control device connection
03	Proportional solenoid valves connection
09	RS232 programming cable
A	Power supply cable

4. Connection type

TYPE	DESCRIPTION
A1	With “AMP Superseal” connector
O2	With flying leads
U1	With eyelet

5. Connector coupling

TYPE	DESCRIPTION
M	Male type

6. Power supply protection

TYPE	DESCRIPTION
F05	Fuseholder with 5A fuse

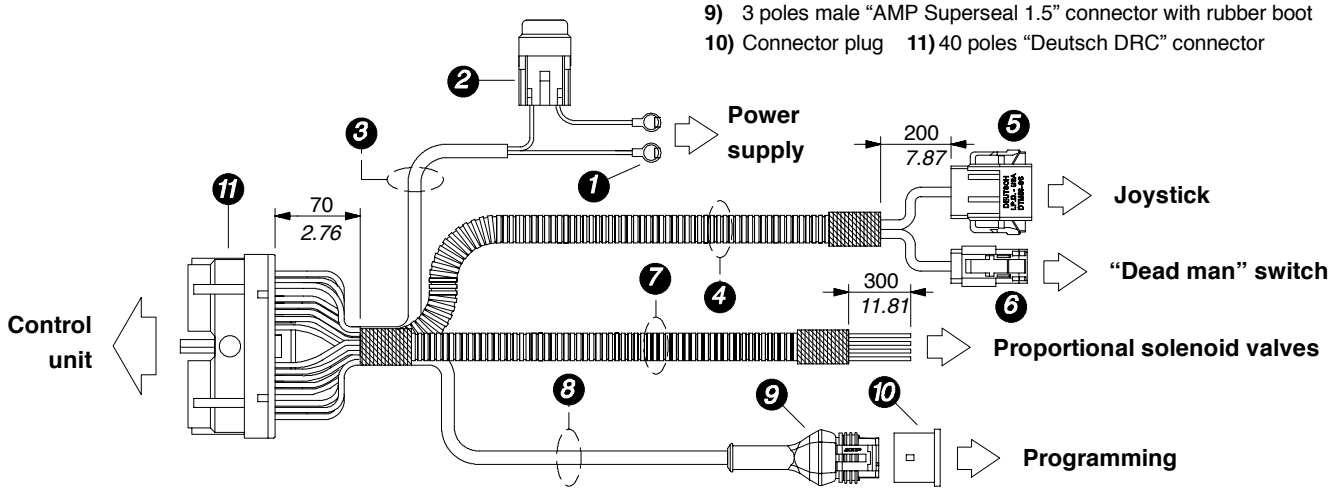
KCD300F cable kit

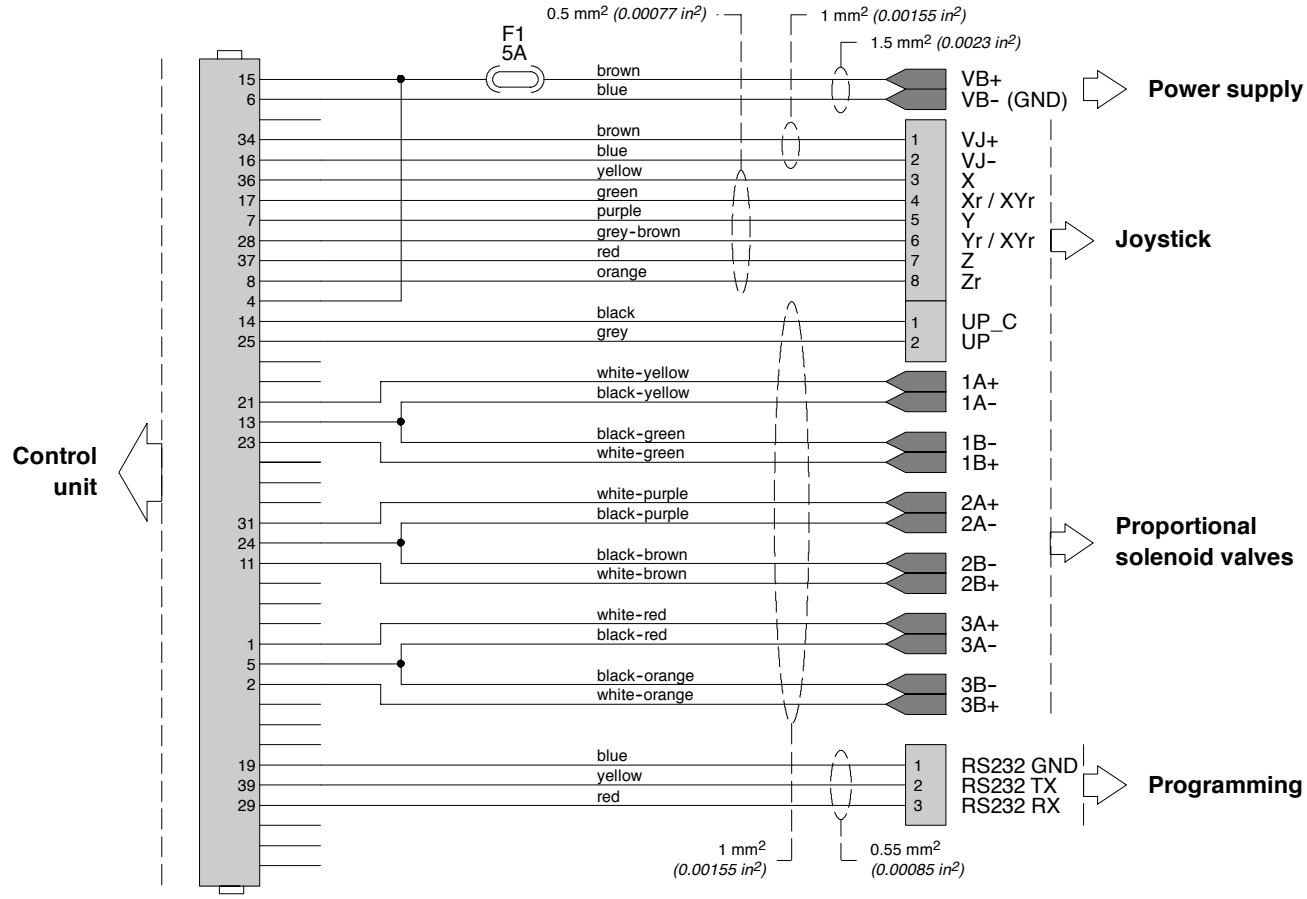
3 *proportional functions*

Available for systems	
PHC100P☐	PHC100F☐
PHC200P☐	PHC200F☐
PHC300P☐	PHC300F■

List

1) Eyelet ∅ 10mm (*0.39 in*)
2) Fuseholder with DIN72581 - 19x20 mm - 5 A fuse
3) Cable 2x1.5 mm² (*2x0.0023 in²*)
4) Wrinkled pipe ∅ 16 mm (*0.63 in*) + nr.4 wires ∅ 2.1 mm (*0.083 in*) section 1 mm² (*0.00155 in²*) + nr.6 wires ∅ 1.7 mm (*0.067 in*) section 0.5 mm² (*0.00077 in²*)
5) 8 poles "Deutsch DTM06-8S" male connector
6) 2 poles "Deutsch DTM06-2S" maschio
7) Wrinkled pipe ∅ 16 mm (*0.63 in*) + nr.12 wires ∅ 2.1 mm (*0.083 in*) section 1 mm² (*0.00155 in²*)
8) 3 poles cable 3x0.55 mm² (*3x0.00085 in²*)
9) 3 poles male "AMP Superseal 1.5" connector with rubber boot
10) Connector plug **11)** 40 poles "Deutsch DRC" connector





KCD cable kit

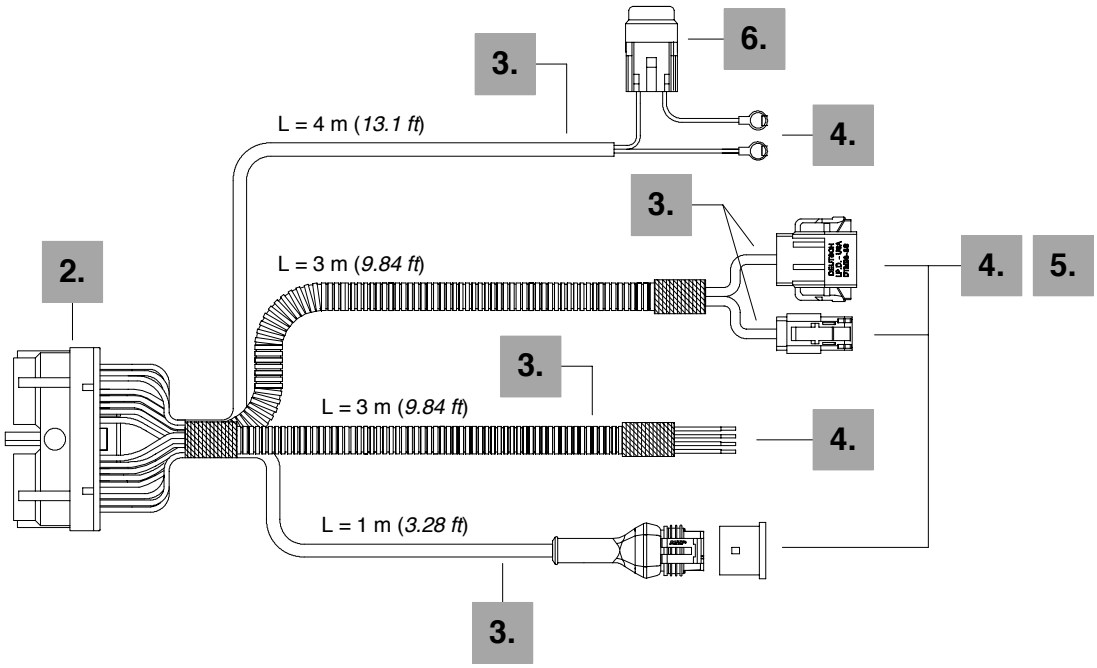
KCD300F description

KCD F 05 / CD3F 40 - 01 D2 M 08 300 (TC) - 02D2M02300(TC) - 03 O2 300 (TC)

- 1. — Nr. of cables
- 2.
- 3. — Nr. of poles
- 4.
- 5. — Nr. of poles
- (TC) — Wrinkled pipe
- 300 — Cable length in cm
- 3.
- 4. — Cable length in cm

- 09A1M03100 (TAP) - A U1 F05 400

- (TAP) — Connector plugged
- 3.
- 4.
- 6.
- 400 — Cable length in cm



1. System family

TYPE	DESCRIPTION
F	For F type PHC system

2. Connettore principale

TYPE	DESCRIPTION
CD3F	Multipolar female “Deutsch DRC” connector

3. Cables numeration

TYPE	DESCRIPTION
01	Proportional control device connection
02	“Dead man” connection
03	Proportional solenoid valves connection
09	RS232 programming cable
A	Power supply cable

4. Connection type

TYPE	DESCRIPTION
A1	With “AMP Superseal” connector
D2	With “Deutsch DTM” connector
O2	With flying leads
U1	With eyelet

5. Connector coupling

TYPE	DESCRIPTION
M	Male type

6. Power supply protection

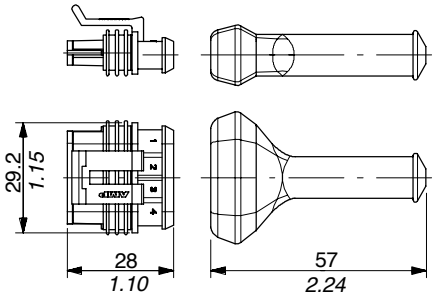
TYPE	DESCRIPTION
F05	Fuseholder with 5A fuse

Connectors

Proportional solenoid valves connection

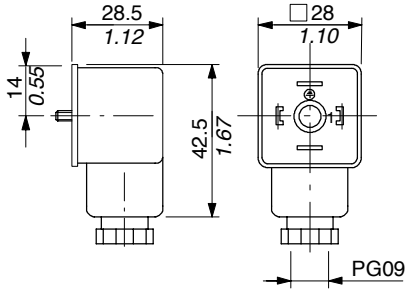
4 poles “AMP Superseal 1.5” connector kit code 5CON140026

Kit includes male connector, female contacts, seals and rubber boot.



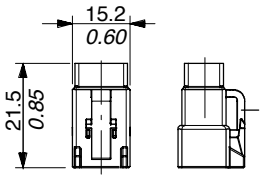
3 poles + GND ISO4400 / EN175301-803 conn. kit code 2X1001030

Kit includes connector, female contacts and seals.



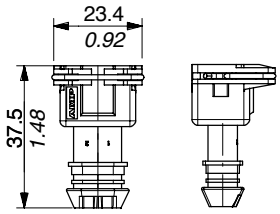
4 poles “Deutsch DTM06-4S” connector kit code 5CON140025

Kit includes male connector, female contacts and seals.



2 poles “AMP JPT” connector kit code 5CON003

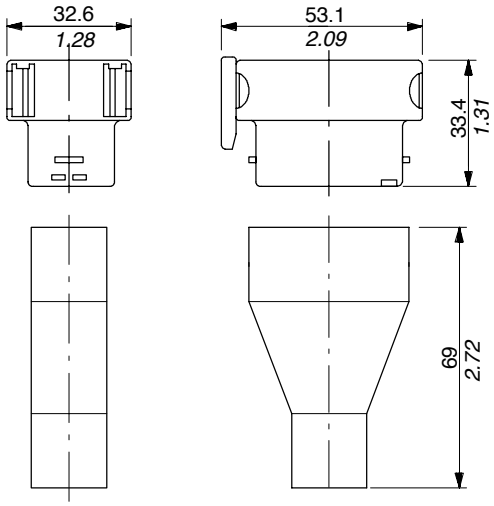
Kit includes female connector, female contacts and seals..



Control unit connection

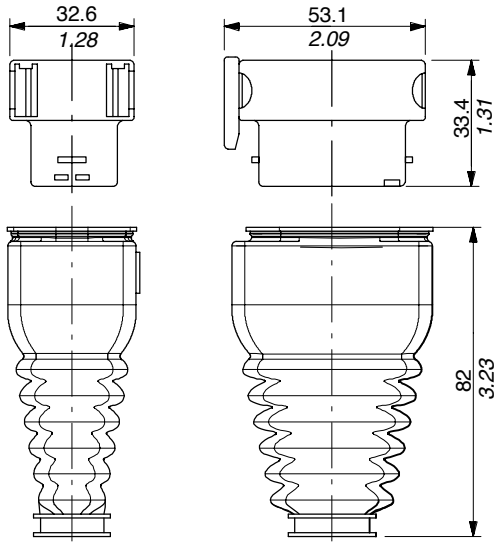
CED110 connection
24 poles "Framatome Sicma 2" connector kit
code 5CON120056

Kit includes female connector, female contacts, seals, rubber boot and contact seat plugs.



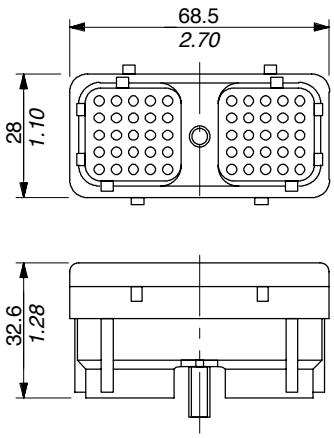
CED251 connection
24 poles "Framatome Sicma 2" connector kit
code 5CON120057

Kit includes female connector, female contacts, seals, rubber boot and contact seat plugs.



CED252 connection
40 poles "Deutsch DRC26" connector kit
code 5CON120058

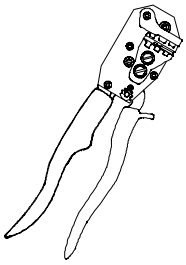
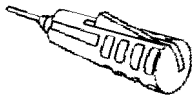
Kit includes male connector, female contacts, seals and contact seat plugs.



Connectors

Tooling

For crimping and removal tools refer to builder reference.

CONNECTOR TYPE	BUILDER REFERENCE	
	Crimping tool	**Pin removal tool**
		
Prop. solenoid valve connection		
Deutsch DTM	HDT-48-00	DT/RT1
AMP Superseal 1.5	354940-1 (tool) 58583-2 (die set)	9-1579007-1
AMP JPT	734767-1	1-1579007-4
Control unit connection		
Framatome SICMA 2	211S 0005 (1.5 contacts) 211S 0006 (2.8 contacts)	210S048
Deutsch DRC	HDT-48-00	0411-240-2005

Walvoil Service Tool

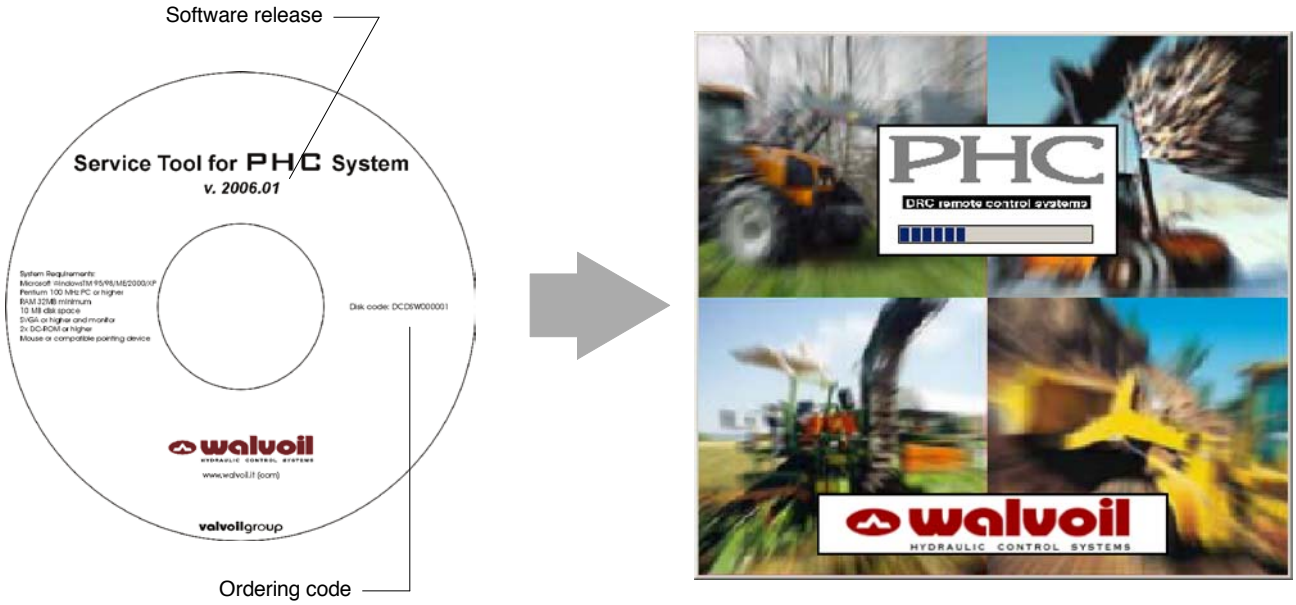
PHC system control units are supplied with operation parameters standard programming, which satisfies most application.
For special applications the WST programming software allows some of the parameters for solenoid valve control to be modified using a personal computer; for example, the minimum and maximum values of linear curve may be defined.
It is necessary require the linking cable shown in the following page.

Minimum system requirements

- Windows 95® operating system or higher.
- Processore166 MHz Pentium® processor.
- 32 Mb RAM.
- CD player unit.
- Connection through a standard RS232 serial port, DB9 connection; alternatively, a USB-RS232 converter can be used (see page 79).

Programm installation

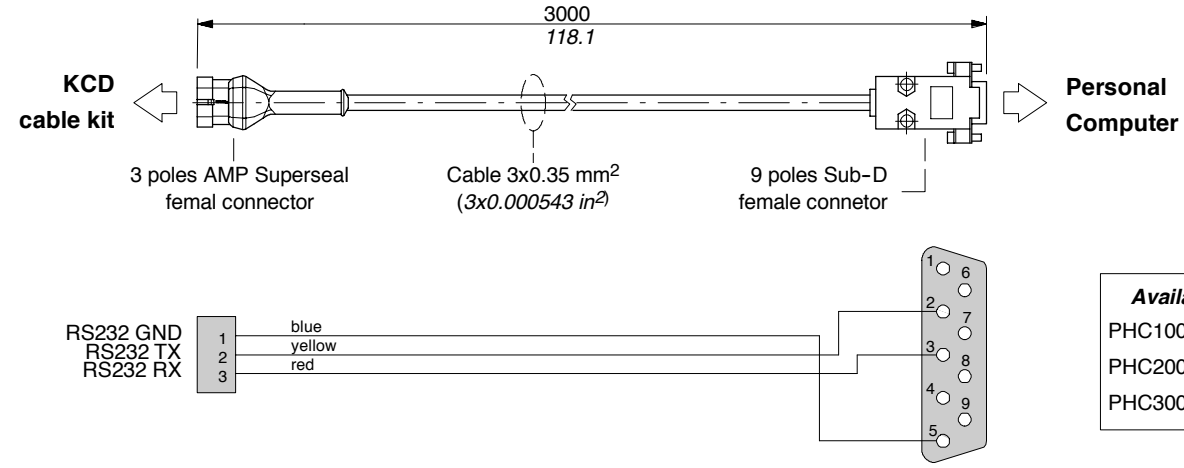
The “WST_PHC” software may be ordered from our Sales Department with code **DCDSW000001**.
To install the WST software onto a personal computer, simply execute the file **setup.exe**.



Programming cables

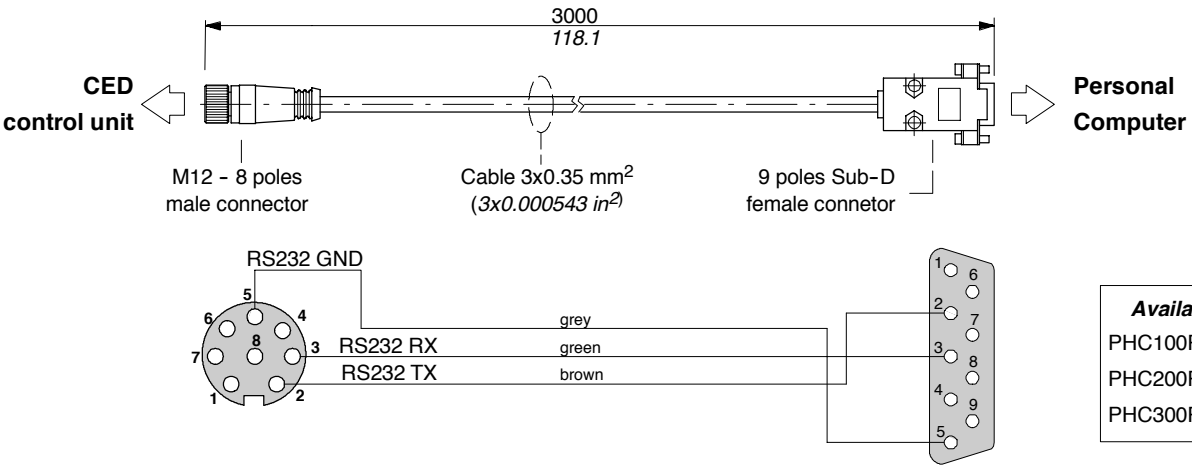
Programming cables for PHC system to Personal Computer connection are available on request.

Cable code: VCAV600014



Available for systems	
PHC100P■	PHC100F■
PHC200P□	PHC200F□
PHC300P■	PHC300F■

Cable code: VCAV600009



Available for systems	
PHC100P□	PHC100F□
PHC200P■	PHC200F■
PHC300P□	PHC300F□

Programming cables

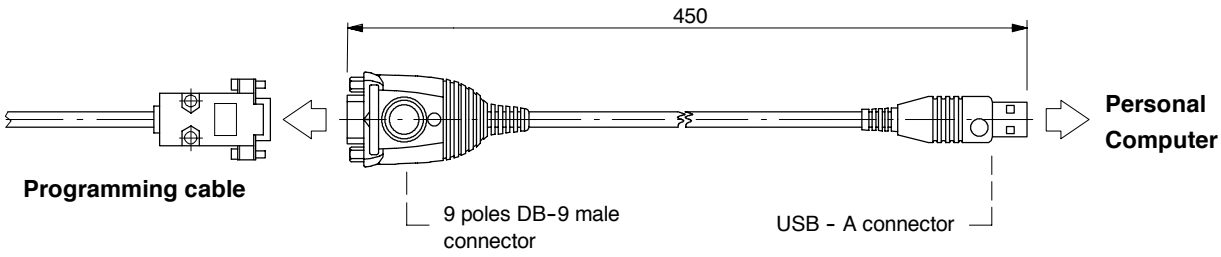
RS232 - USB converter

It allows PHC system to Personal Computer connection when the latter is unprovided of serial port; for installation follow instruction enclosed with converter.

Technical data

Supported operating systems . . . . : Windows® 98, 2000, ME
USB connector . . . . . : type A male
RS232 connector . . . . . : DB9 male
Working temperature . . . . . : from 0°C to +50°C

Cable code: W0420001



Electric recommendations

General

Keep to the listed recommendations regarding electrical connections, the laying of cables, the use of connectors, etc.

- WARNING Before installing, carrying out maintenance, or replacing the electrical circuit, make sure that the electrical power to the circuit has been disconnected.
  Place all of the actuators on standby (on the ground, at the lowest point, etc.), discharge all of the accumulators, and secure loads whose accidental movement could cause damage or generate pressure.
- WARNING If possible, carry out welding operations on the machine's chassis before installing the electronic components; otherwise, the electrical system must be disconnected.
  Always disconnect the negative cable from the battery first and then the positive cable.
  The welder's ground cable must be positioned as close to the welder itself as possible.
  Avoid positioning the cables of the welding unit near the system's electrical circuit.
- WARNING The system must always be equipped with an EMERGENCY STOP button that disconnects power to the circuit. It must be positioned at a point on the machine that is easily accessible to the operator.
- WARNING The machine must be constructed so that it guarantees that power will be cut off to the circuit if the operator leaves the control panel.

Wiring

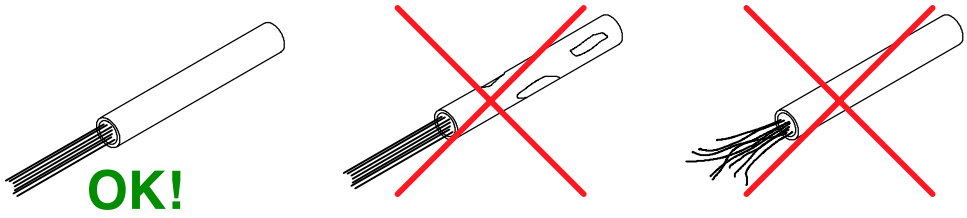
- CAUTION According to experience, a high number of electrical and electronic malfunctions is due to problems with wiring and electrical connections.
- Use cables with sheaths resistant to oils such as PUR (polyurethane) or PTFE (polytetrafluoroethylene).
- Avoid using cables or leads with cracked or worn insulating sheaths.
- Avoid positioning them near communication devices, antennas, generators, and other sources of high-frequency interference. Separate the control circuit cables from any antenna cables.
- Separate the control circuit's power supply from the communication circuit's power supply.
- Ensure good contact with the battery's negative terminal.
- If possible, pass the cables through the inside of the machine's metal structures; alternatively, secure the cables in a corner between two metal surfaces or on a flat metal surface.
- Protect the cables from wear due to rubbing.
- Whenever possible, avoid positioning cables without securing them; any unfastened cables must be fitted so that they cannot become wound and flattened.
- If the cables are in contact with sharp edges (eg: holes in sheet metal), protect them with plastic sheaths and conduits.
- Secure the cables using tape, clamps, glue, or other devices. If clips are used, do not secure them too tightly since the leads inside the cable could be damaged.
  The distance between the points at which the cables are secured must guarantee protection against vibrations produced by the chassis.
- If movement is required, the length of the wires must permit bending. Avoid stretching and twisting the cables.
  The minimum bending radius of the cables must not be less than 20 times the diameter.

General

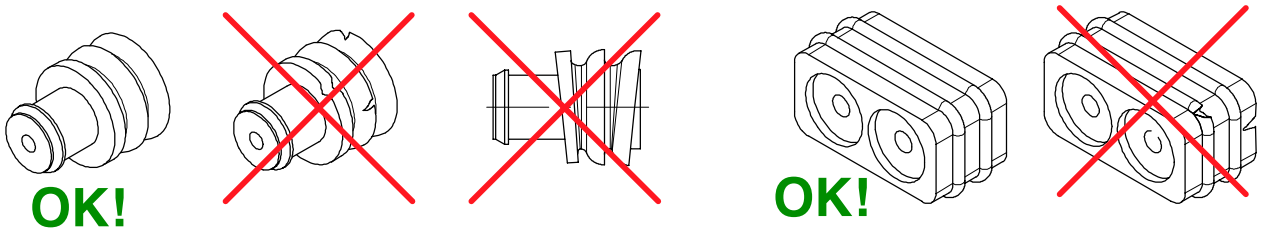
Connectors

A good electrical connection between the control circuit and the directional control valve's electronics is fundamental to proper system operation.
Properly attached connectors, accurately secured leads, and the right use and positioning of the seals ensure suitable contact, mechanical resistance, and insulation from external agents necessary for preventing malfunctions and incorrect operation.

- Assembly of the cable inside the connector ensures two functions: Electrical contact and mechanical attachment.
  A connector that is assembled and fitted incorrectly can cause sporadic malfunctioning that is difficult to identify.
- **CAUTION** Always use brand-name connectors with technical characteristics (degree of protection, capacity, contact type and material, etc.) that are compatible with similar devices present on the valves
- Always use suitable tools: when the lead is not tighten into the connector with screws, a crimper (for securing the lead to the contact) and an extraction tool (for removing the contacts from the connector) are generally necessary.
- The wires prepared for contact crimping must be in good conditions: the wire insulation must have smooth surface in a round form without damage, groove or recessed surface and the end shall appear neat without any bend of stranded conductor.



- Connectors provided for the wiring need seals from the cable side, supplied with series, which protect the connector from damp and impurity.
  Before assembling check the seals: they must be faultless.



- The cable's angle out from the sealing must not excessive: contact supplier for details.

HYDRAULIC CONTROL SYSTEMS

WALVOIL S.P.A.

42100 REGGIO EMILIA • ITALY • VIA ADIGE, 13/D
TEL. +39.0522.932411 • FAX +39.0522.300984
E-MAIL: INFO@WALVOIL.COM • HTTP: //WWW.WALVOIL.COM

SERVIZIO COMMERCIALE

TEL. +39.0522.932555 • FAX +39.0522.932455

DET001A