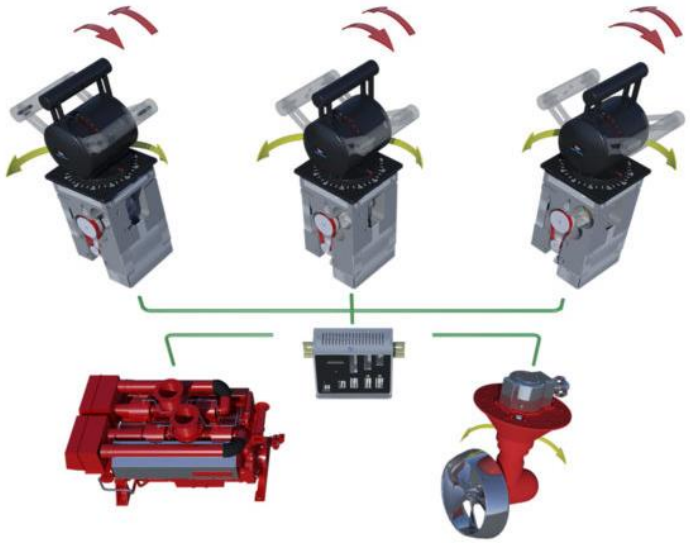
Systems: Electric shaft system



The Kwant Controls levers are primarily used for electronic Remote Control of marine propulsion plants, which typically consist of a combination of engine / propeller / gearbox / clutch sub-assemblies. Remote Control is done from bridge level (WH Fwd, WH Aft, Port side wing or Stbd side wing). To achieve this, the levers are equipped with signal transmitters for engine RPM, clutch direction etc. that are wired to the propulsion plant control system.

Telegraph systems

In case the Remote Control (RC) system is out of order, a switch over to telegraph mode can be made. The same levers are now used to send telegraph commands from the wheelhouse to the engine control room (ECR) or engine room (ER), whichever is selected as the current reply position. An alarm will sound until the command has been acknowledged. The propulsion plant is now remotely controlled from the ECR- or ER levers, or manually in case the ER lever has no remote control transmitters.

Electrical shaft systems

The purpose of an electrical shaft system is to synchronize the operating levers of all control units connected, mostly on the main bridge and bridge wings. It enhances the ease of use and increases safety in emergency situations, since control can be taken directly from any of the operating positions connected. Synchronization enables switching of operating position without changing the control signals for propulsion and/or heading (bump-less take-over). A second advantage is that the transmitters providing these signals are required on just one of the control units, since all levers will move simultaneously. To achieve synchronization, the control units are equipped with servomotors. Electronic circuitry will take care of driving these motors, as well as handling the take-over requests. Take-over can be achieved by means of illuminated pushbuttons, or by potential free contacts from other systems.

Kwant Controls B.V. | P.O.Box 23 8600 AA Sneek-Holland |
www.kwantcontrols.com | kwant@kwantcontrols.nl | Telephone +31 (0)515 413745

Specifications

This latest generation of electric shaft systems is based on stepper motor driven levers and CAN bus technology. It merges the traditionally separated telegraph- and electric shaft systems into one combined system, thus providing much improved flexibility and reduction of installation time and cabling costs. The application of stepper motors introduces a number of features such as programmable detents, haptic feedback and very accurate fine adjustment that could not be realized with the traditional DC-motor technology. The CAN bus is a widely spread and rugged serial bus system that has its roots in the automotive industry where extremely severe demands must be fulfilled. The electronics have been completely distributed over the operating positions, thus eliminating the traditional central cabinet.

The electronic module that interfaces the control units to the CAN-bus is known as the CUBI, short for Control Unit to Bus Interface. The basis for the communication with the module is the CAN-open protocol. The CUBI module contains a single printed circuit board and can handle two servomotor controllers and eight digital in- and outputs, while providing two CAN-bus transceivers for bus redundancy. The CUBI module has a seawater proof stainless steel housing that can easily be clicked on a 35/7.5mm DIN-rail according to EN-50022A. Polyurethane based coating is protecting the sensitive parts of the printed circuit board.

For the connection to the ship's cabling, pluggable connectors are used. This eases the installation and replacement of the module. Cables with D-Sub connectors are used for the lever side of the module.

Each Elas-5 system can handle a maximum of eight control units (nodes), a maximum of four of these systems can be tied together thus allowing a maximum of 32 control units to operate in full synchronicity.

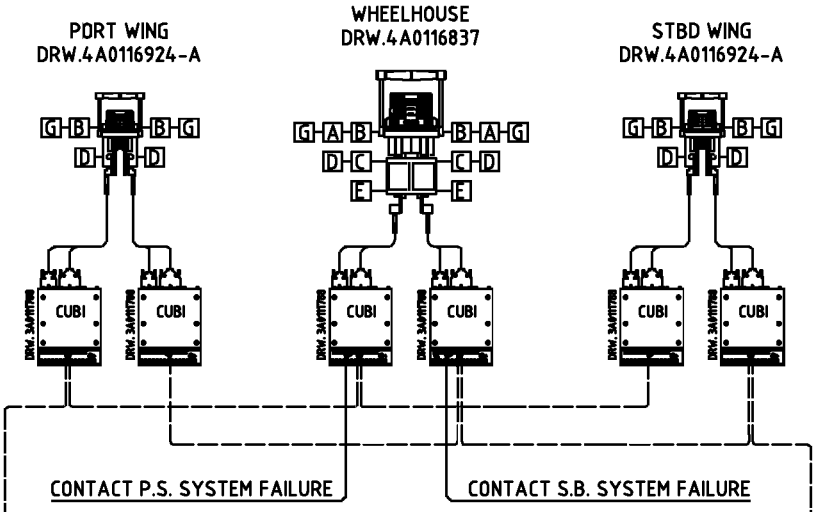
Options

- Central take over.
  In a standard system, selection of the master lever is done by means of a simple illuminated pushbutton, wired directly to the corresponding CUBI module (= local take over). In case the position take over has to be achieved by means of another control system, the pushbuttons are replaced with potential free contacts (one for each position), that can all be wired to a single CUBI module.
- Tandem mode.
  Also known as 'one lever mode', this option allows the operator to control up to four propulsion plants with just one lever, for more operating comfort. To achieve this, the CAN-buses of Port side and Stbd side systems are linked together by means of an isolated CAN repeater.
- Electrical fine adjustment.
  For events like convoy sailing, which require very precise setting of the engine speed or propeller pitch, the manual lever movement is often too course. To overcome this problem, the system can be expanded with pushbuttons for electrical fine adjustment that will move the lever in the desired direction very slowly. The CUBI module now uses modified micro-stepping to achieve optimum precision.

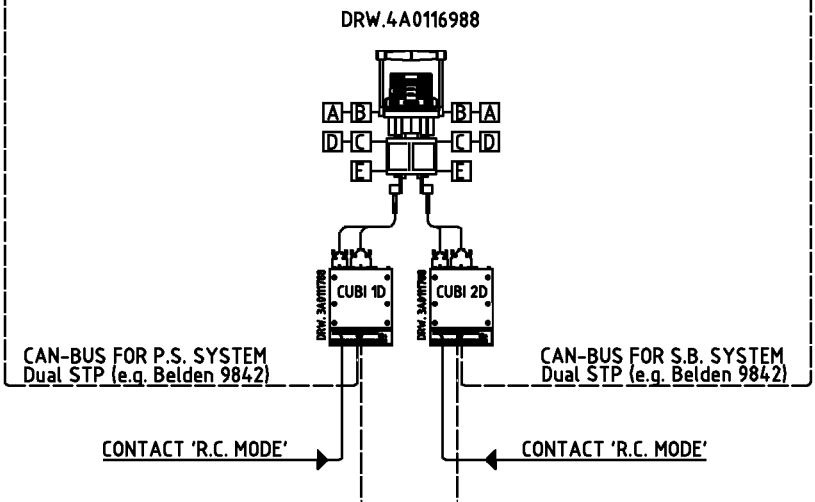
- Haptic feedback.
  To limit the allowed operating range of a control lever, a so called ‘haptic feedback’ can be activated to prevent the lever from being moved outside this area. The servomotor will try to push the lever back, causing a vibration in the lever to let the operator know that he is leaving the safe operating area.
- Sub-telegraph commands.
  Up to three illuminated pushbuttons may be connected to transfer and acknowledge the so called sub-telegraph commands such as ‘stand by’, ‘finished with engine’ and ‘at sea’. Sub-telegraph commands are always sent from bridge to ECR or ER. An intermittent audible alarm (1 Hz) is used to distinguish from the propulsion telegraph alarm.
- Programmable detents.
  The servomotors that are used for moving the control lever when a control unit is in slave mode, can also be used to create the feeling of a mechanical detent (palpable stop) when the control unit is in master mode. By default, there is a detent in the neutral position, others can be programmed e.g. at the clutching positions or optimum engine RPM. Another example: when in telegraph mode, all commands will now have detents in the center of each command field. A maximum of 16 detents can be programmed for each motor.
- External signals.
  Two inputs for external 0-20mA signals are available, from e.g. a joystick- or speed pilot system. This allows automatic lever line-up with the external signal source and provide bump less switching over from lever to external control and vice versa.

A		MICROSWITCHES REMOVED	03-02-09	J.Z.
B		CAN BUS CABLE SPECIFICATION (BELDEN 9842)	17-02-09	TTW

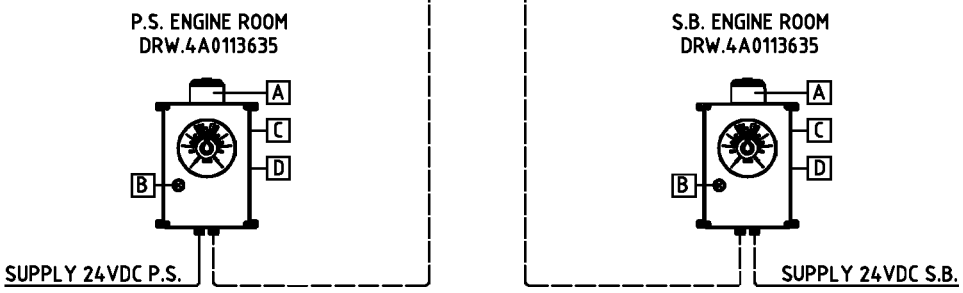
BRIDGE LEVEL



E.C.R.



E.R.

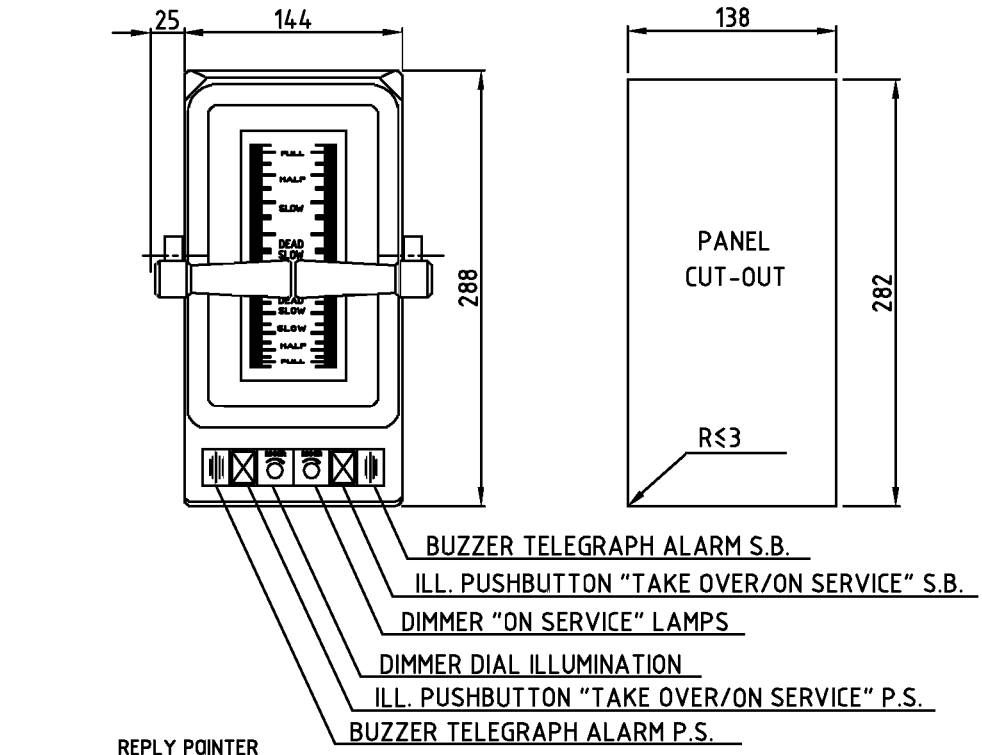


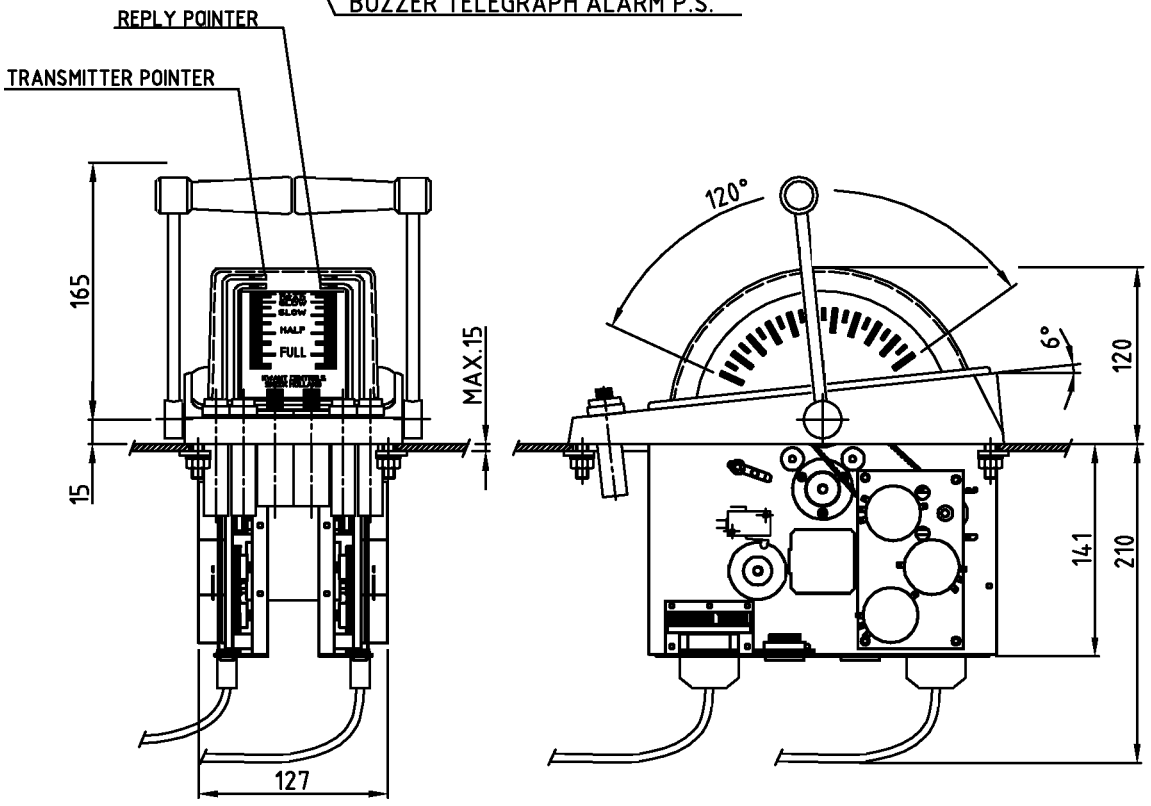
NOTES:

* EACH CUBI REQUIRES 24VDC POWER SUPPLY
* REDUNDANT CAN-BUS NOT SHOWN FOR CLARITY REASONS

A = BUZZER TELEGRAPH ALARM
B = ILL. P/B 'TAKE OVER / ON SERVICE'
C = SERVOMOTOR POINTER
D = SERVOMOTOR LEVER/KNOB
E = R.C. TRANSMITTER 4..20mA
G = DIMMER

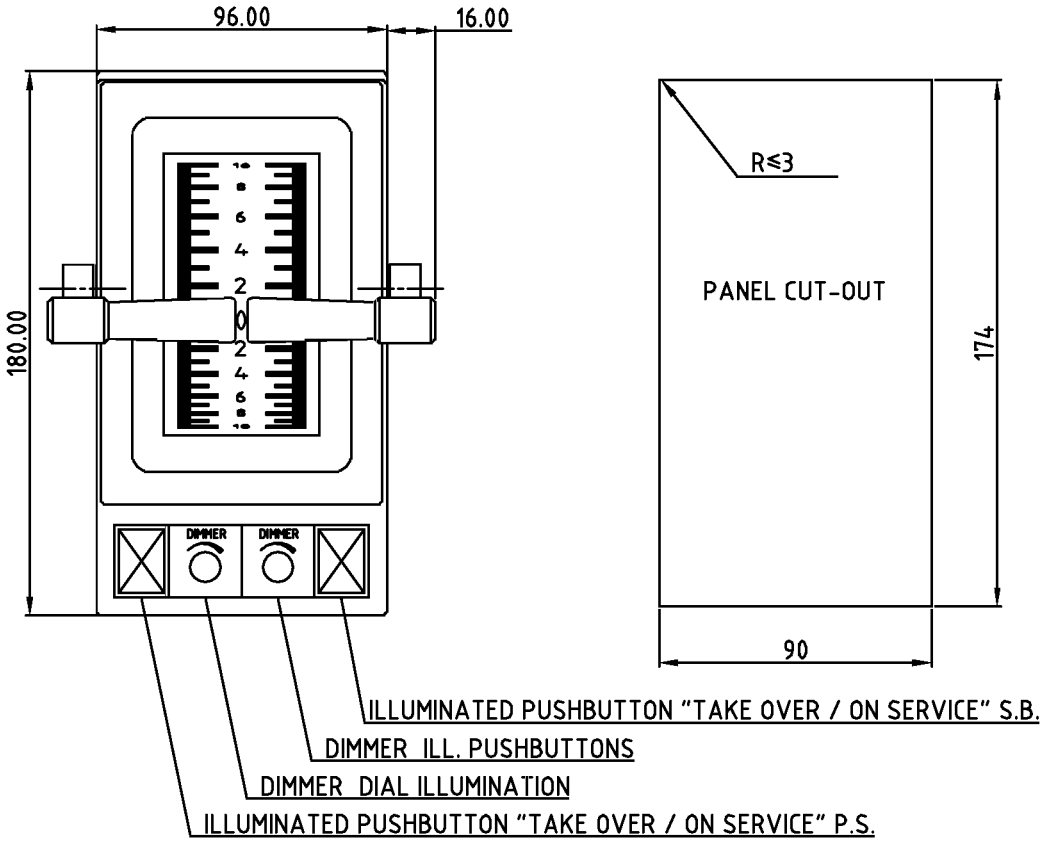
PROPOSAL DIAGRAM REMOTE CONTROL SYSTEM WITH INCORPORATED TELEGRAPH AND ELECTRIC SHAFT	4 A0117248	PROJ. METHODE
KWANT CONTROLS KWANT CONTROLS B.V. SNEEK HOLLAND HET AUTEURSRECHT WORDT VOORBEHOUDEN OVEREENKOMSTIG DE WET	WIJZ. B GET. TTW D.D. 06-10-08 GEZ. SCHAAL: BLAD.	

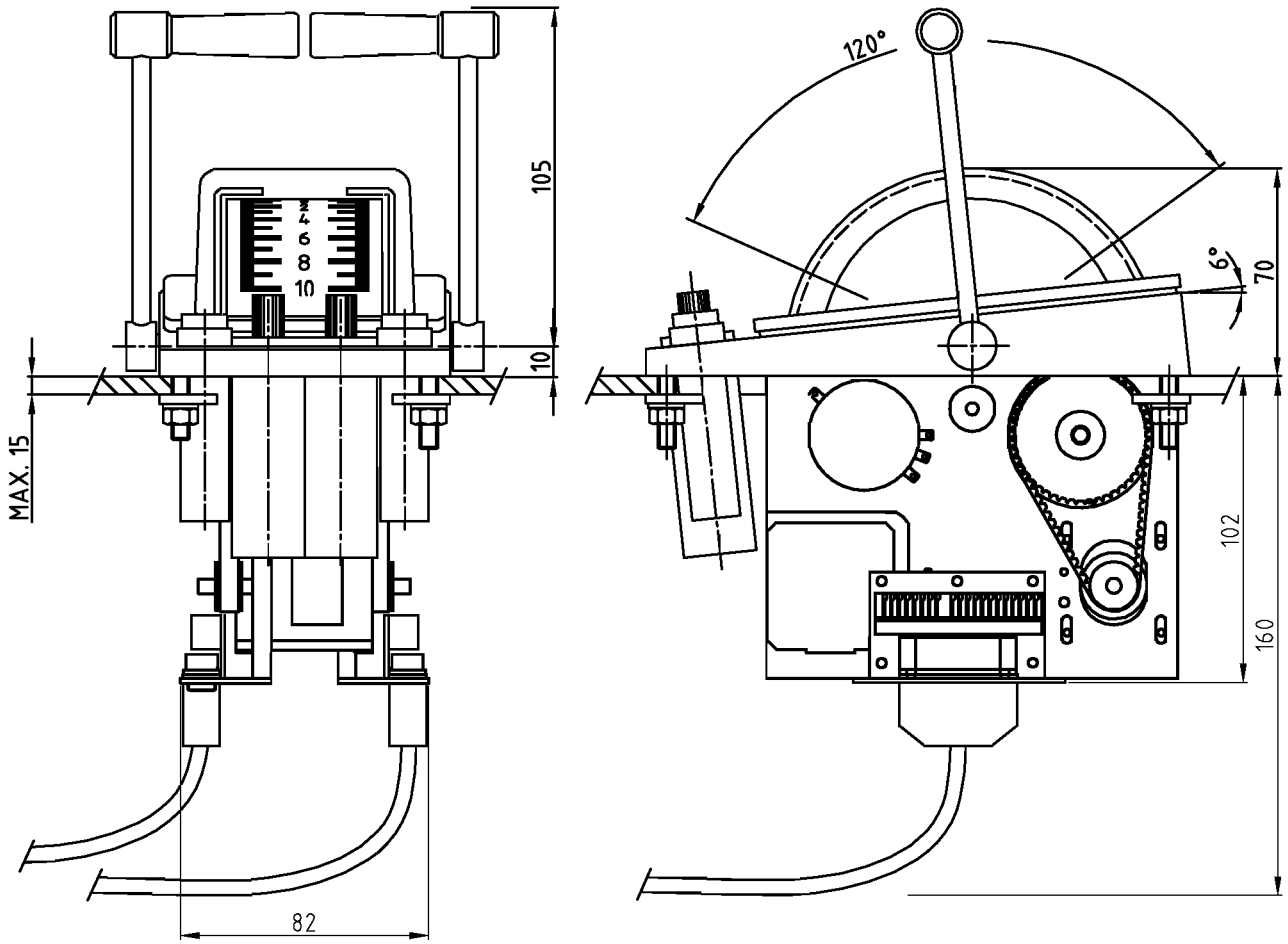




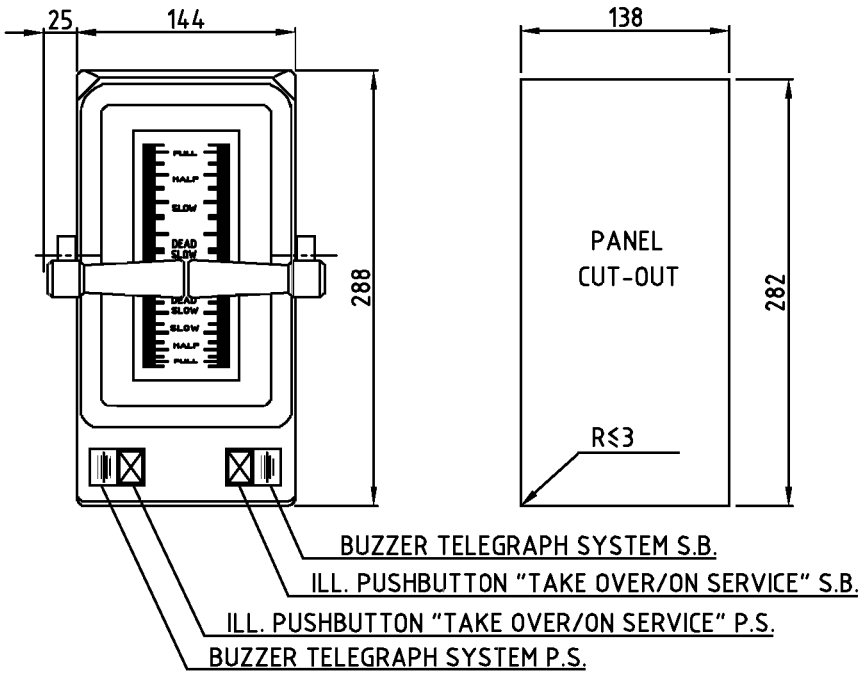
CONTROL UNIT TYPE BUK-B	4 A0116837	PROJ. METHODE
KWANT CONTROLS KWANT CONTROLS B.V. SNEEK HOLLAND HET AUTEURSRECHT WORDT VOORBEHOUDEN OVEREENKOMSTIG DE WET	WIJZ.	
	GET. EVD D.D. 19-05-08 GEZ.	
	SCHAAL: 1:5 BLAD.	

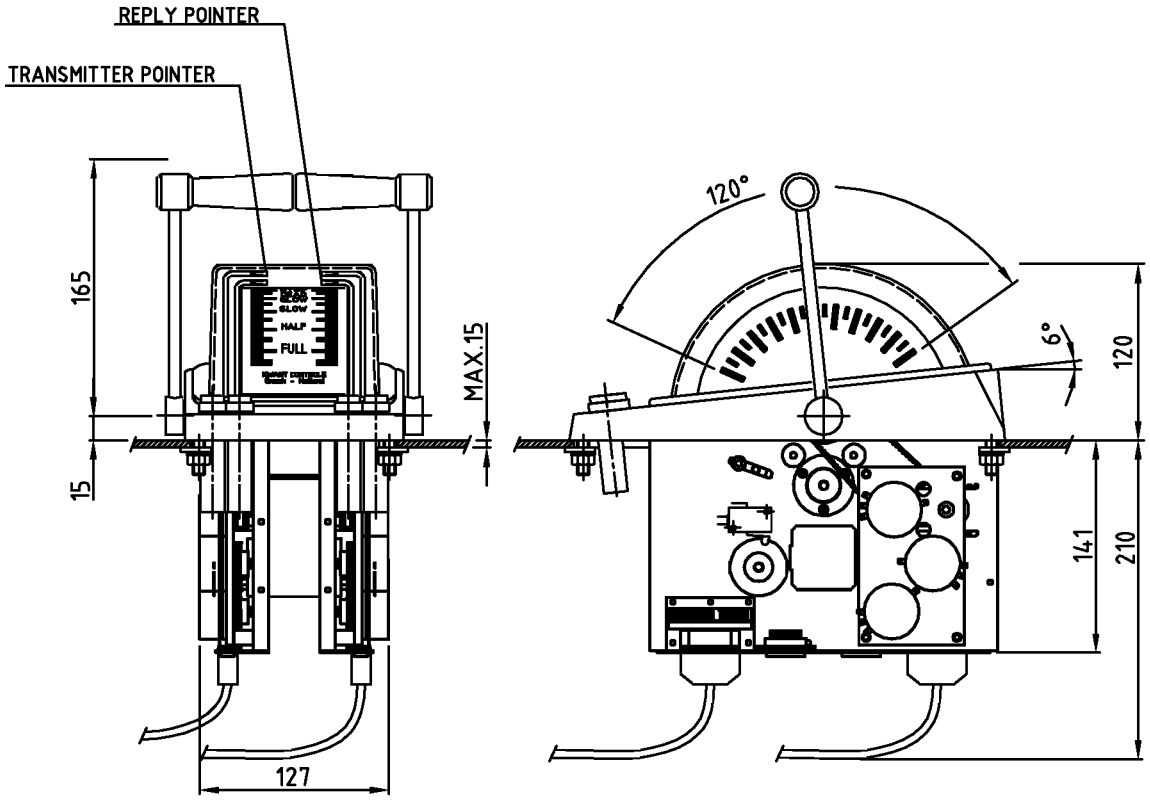
A		TWO DIMMERS	24-06-08	TTW





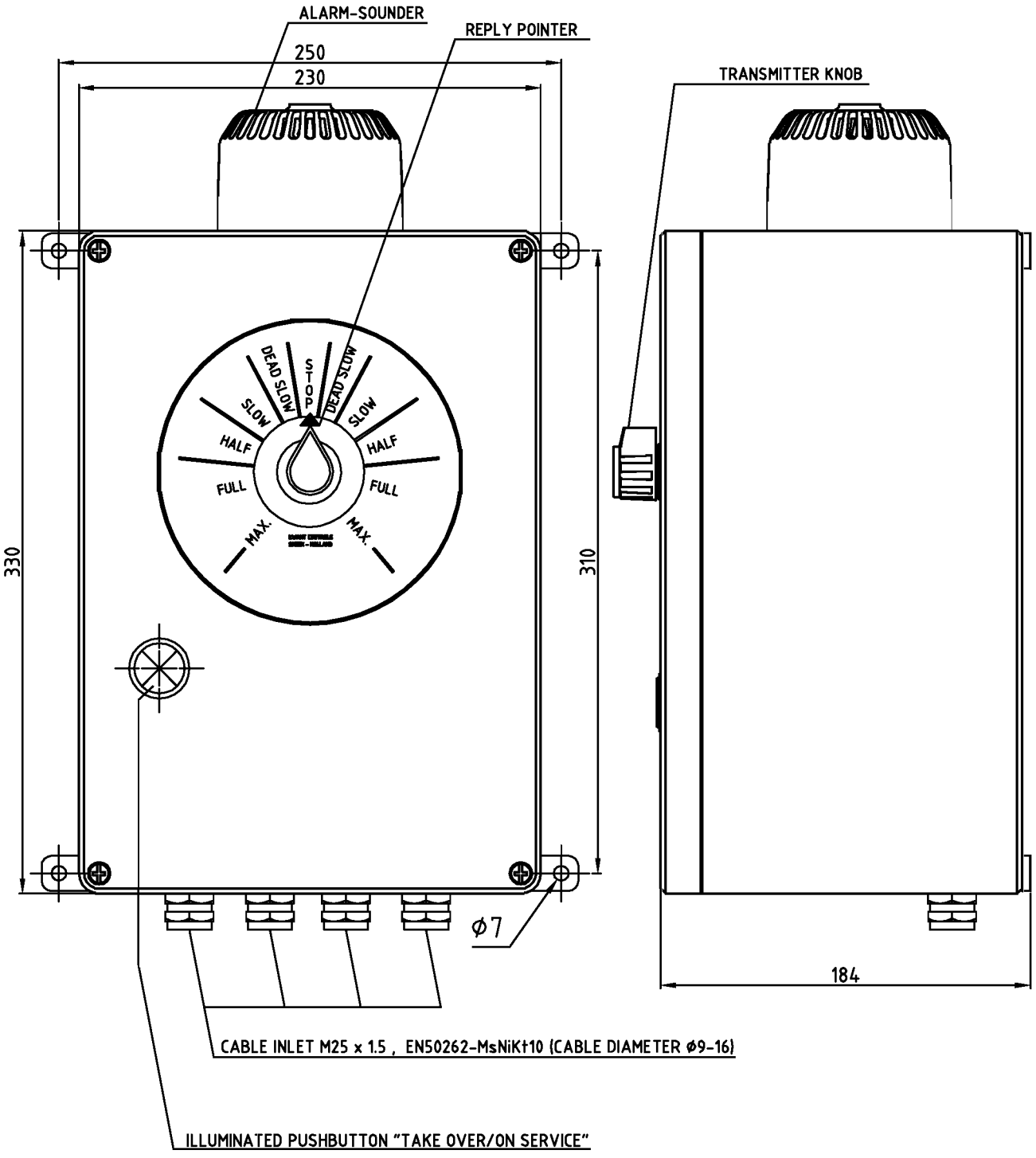
CONTROL UNIT TYPE BUK C EXT.	4 A0116924	PROJ. METHODE
KWANT CONTROLS KWANT CONTROLS B.V. SNEEK HOLLAND HET AUTEURSRECHT WORDT VOORBEHOUDEN OVEREENKOMSTIG DE WET	WIJZ. A	
	GET. DTI D.D. 10-06-2008 GEZ.	
	SCHAAL: 1:2.5 BLAD. BUK C EXT	



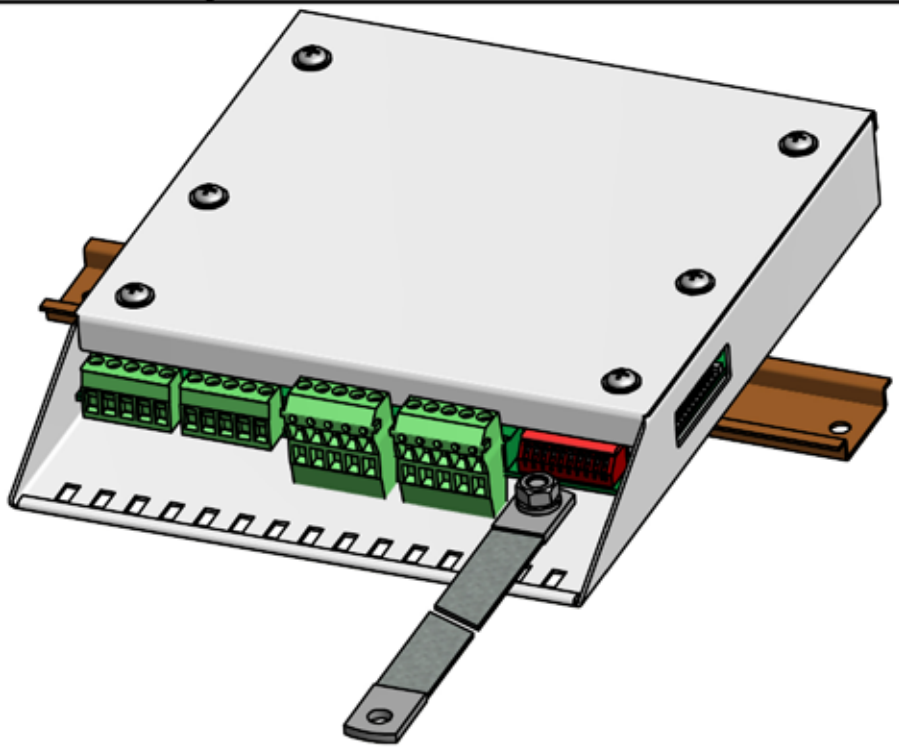


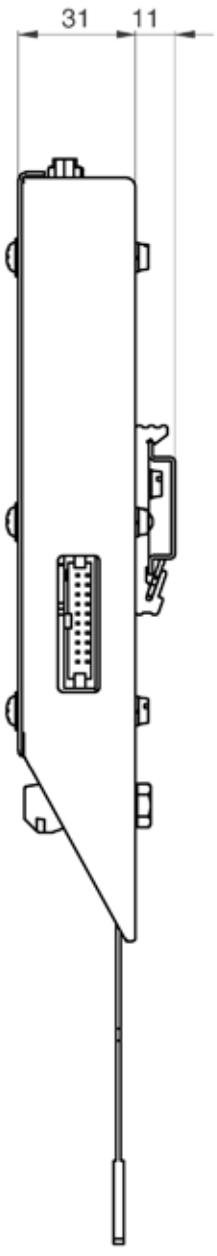
CONTROL UNIT TYPE BUK-B	4 A0116988	PROJ. METHODE
KWANT CONTROLS KWANT CONTROLS B.V. SNEEK HOLLAND HET AUTEURSRECHT WORDT VOORBEHOUDEN OVEREENKOMSTIG DE WET	WIJZ.	
	GET. TTW D.D. 24-06-08 GEZ.	
	SCHAAL: 1:5 BLAD.	

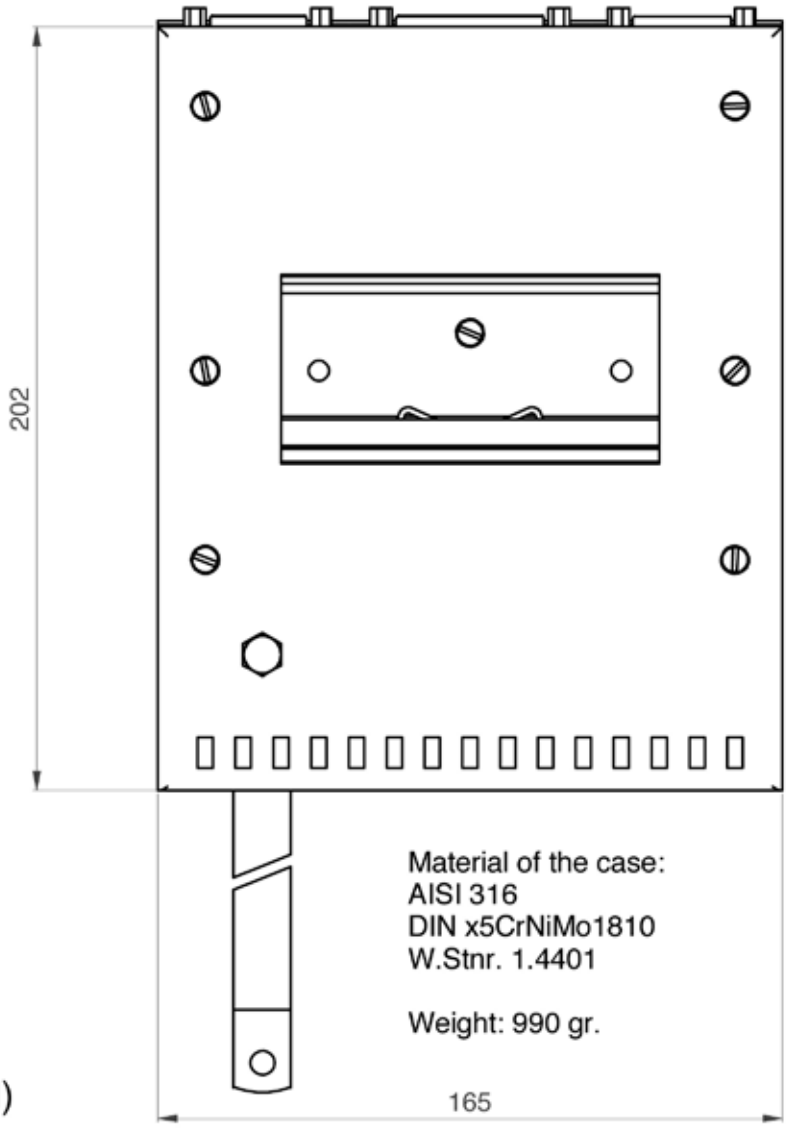
B		4 CABLE GLANDS W10-16	15-12-05	TTW
C		CABLE INLET M25	01-02-08	GE



R/T POINTER WD, BULKHEAD MOUNTED	4 A0113635	PROJ. METHODE
KWANT CONTROLS KWANT CONTROLS B.V. SNEEK HOLLAND HET AUTEURSRECHT WORDT VOORBEHOUDEN OVEREENKOMSTIG DE WET	WIJZ. C	
	GET. EVD D.D. 14-06-05 GEZ.	
	SCHAAL: 1:3 BLAD.	







Material of the case:
AISI 316
DIN x5CrNiMo1810
W.Stnr. 1.4401

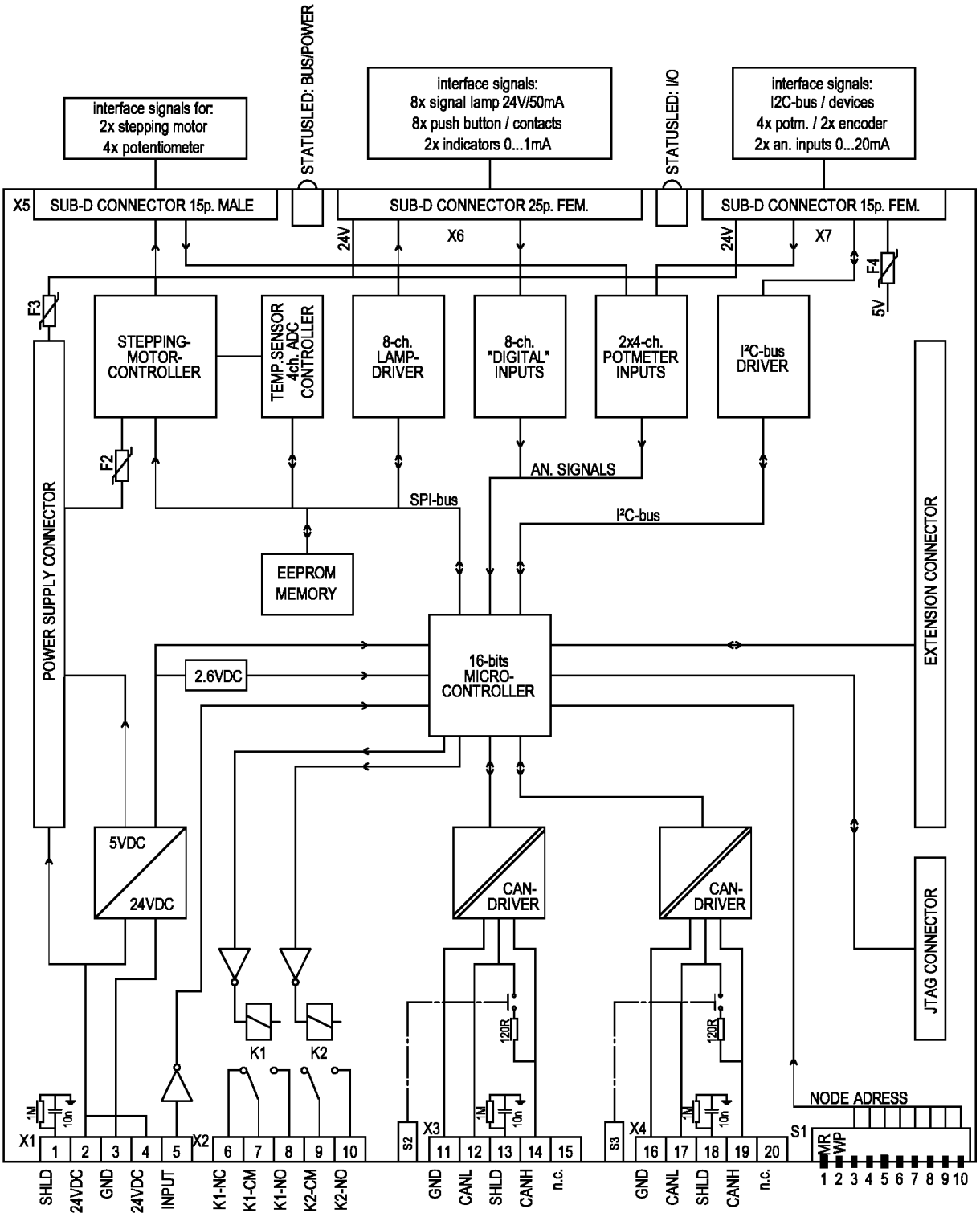
Weight: 990 gr.

(CUBI)

Control Unit to Bus Interface

KWANT CONTROLS KWANT CONTROLS B.V. SNEEK HOLLAND	Maten in millimeters	Form. A4	4A0120194
		Wijz.:	Art.:
	HET AUTEURSRECHT WORDT VOORBEHOUDEN OVEREENKOMSTIG DE WET	Get.: KvO	Get.dd.: 18-1-2011
		Schaal: 1:2	Status:Proto
		L.Wijz.dd.:	Blad: 1 /1

LET.	ST.NR.	WIJZIGING	D.D.	NAAM
A	-	ADDED CONNECTOR NAMES	23-02-2007	RW



BLOCK DIAGRAM P.C.B.112000

4 A 0111786

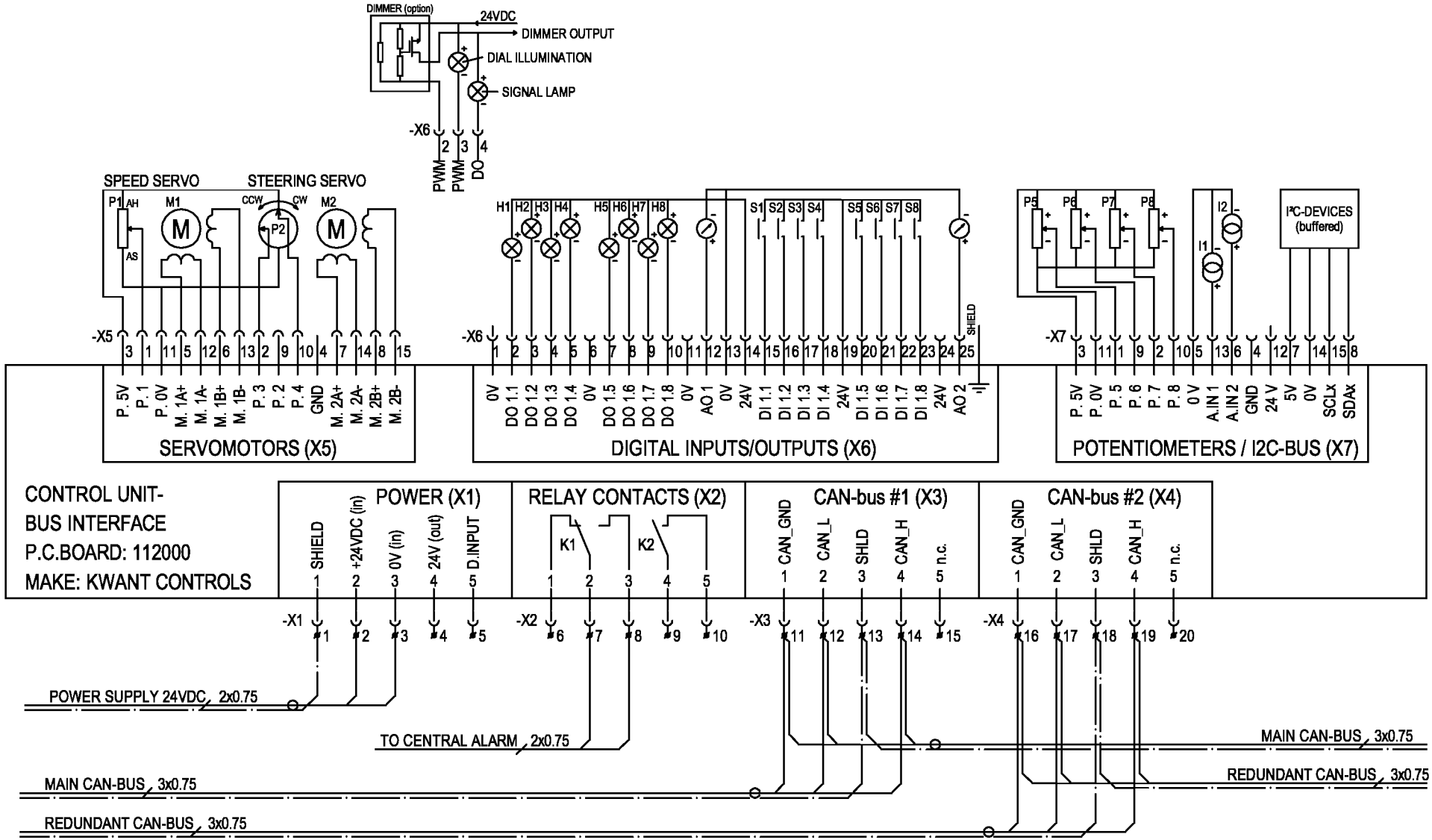
PROJ. METHODE

KWANT CONTROLS

KWANT CONTROLS B.V. SNEEK HOLLAND

WIJZ.	A		
GET. NJV		D.D. 24-9-2003	GEZ.
SCHAAL: -		BLAD. 1	

LET.	ST.NR.	WIJZIGING	D.D.	NAAM



CUBI, CONNECTIONS P.C.B.112000

3 A 0112202

PROJ. METHODE

KWANT CONTROLS

KWANT CONTROLS B.V. SNEEK HOLLAND

WIJZ.

GET. NJV D.D. 16-2-2005 GEZ.

SCHAAL: - BLAD. 1 OF 2