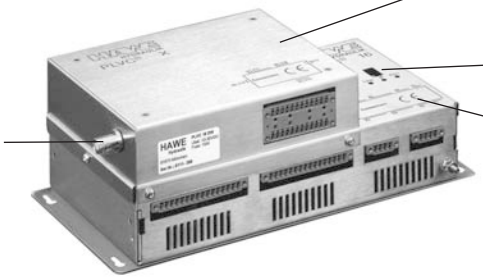
# Programmable logic valve control type PLVC 16

CE

See also other electronic valve controls/accessory:

| | |
|---|---|
| Type PLVC 2 | acc. to D 7845-2 |
| Type PLVC 4 | acc. to D 7845-4 |
| Type PLVC-CAN | acc. to D 7845-Z |




## 1. General information

The programmable logic valve control of type PLVC 16 consists of a complex PLC-enabled micro-control unit with integrated amplifiers for mobile and stationary hydraulic applications.
The wide range of possible applications includes, among others:

- Cranes, crane systems
- Construction machines
- Complex hoisting equipment
- Logging equipment
- Hydraulic clamping systems for machine tools
- Presses

The various control tasks are realized through:

- A modular system with extension and supplementary modules
  - Basic module
  - Extension module (additional inputs/outputs, receiver for radio control) (optional)
  - Text display for diagnosis, and parameterization (via CAN-Bus)
  - Large display for diagnosis, and parameterization (via CAN-Bus)
  - CAN-Bus controlled power relay
- Flexible programmability according to IEC 61131-3 standard (PLC-programming via instruction list (IL), function block diagram (FBD) or structured text (ST))
- Various interfaces (RS232, CAN-Bus)
- Free parameterization of all outputs, as well as complete diagnosis capability and short-circuit protection
- Remote diagnosis via modem or mobile phone
- Combination of multiple PLVC's via CAN-Bus within one integrated unit for the control of complex systems

All relevant standards regarding personal safety, EMC, vibration- and shock-proofness are complied with.

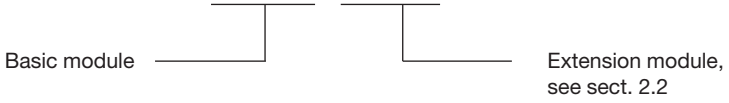
The main performance parameters include furthermore:
(the values in brackets specify the performance range of the basic module)

- Input
  - Max. 24 (8) digital inputs (for limit switches, pressure switches, push buttons, etc.)
  - Max. 24 (8) analog inputs (for joysticks, potentiometers, sensors such as analog pressure sensors)
  - Emergency-Stop signal (opto-decoupled)
  - 4 (1) frequency inputs (for indexing switches, rev. counter, incremental encoder, etc.)
  - Optionally integrated radio control module (receiver) incl. Emergency-Stop lock
  - Power supply 10 ... 30 VDC, max. 16 A
- Output
  - Max. 32 (16) outputs for prop. or ON/OFF valves
  - 2 analog outputs 0 ... 10 VDC
  - Emergency-Stop signal
  - 2 programmable auxiliary voltage outputs (5, 8, 10, 12 VDC, max. 500 mA, e.g. for potentiometer supply)
  - 3 Relay outputs
  - 7- segment display on basic module for error detection
- Functional software features
  - PLC programming via IL, FBD or ST
  - Parameterization during runtime
  - CAN-Bus integrated in the operating system

# 2. Available versions

## 2.1 Basic module

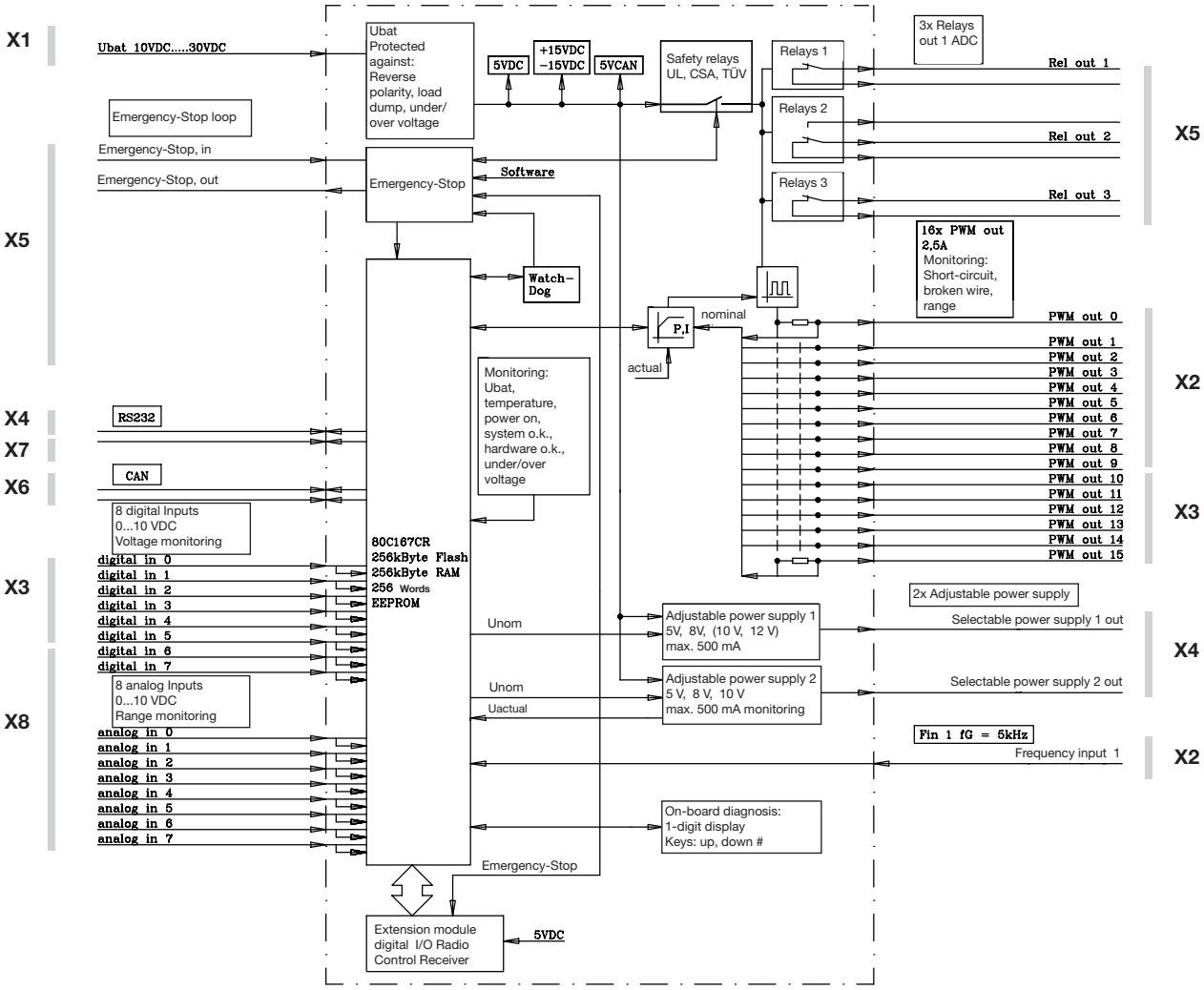
Order examples: **PLVC 16 - G**
**PLVC 16 - X - ABC**




**General data**

| | |
|---|---|
| Casing, protection class | IP 20 acc. to DIN EN 60529 / IEC 60529 |
| Temperature range | -40°C to +80°C |
| Power supply | 10 VDC to 30 VDC |
| Max. total current | 16 A |
| Required external fusing | 15 A (slow blow) |
| Protection | Reverse polarity protection<br>Load dump protection (DIN 40839)<br>Shock proof (vibration: IEC 68-2-6, shock: IEC 68-2-27)<br>EMC (EN 50081-1, EN 50081-2, EN 58082-1, EN 58082-2) |
| Monitoring | Short-circuit, undervoltage and overvoltage<br>Cable break |
| Cable connections | via plug system Phoenix, type MKDS (the connector rails are coded) |
| Micro controller | 80C167, 16 bit |
| Basic parameter memory | EEPROM 256 words |
| Memory | Flash: 256 kByte<br>RAM: 256 kByte |
| Accessories | Plug set (see sect. 2.3.1)<br>Software<br>Diagnosis display (see D 7845 Z)<br>CAN-Bus power relays (see D 7845 Z)<br>CAN-Bus display (see D 7845 Z) |
| Mounting | 4 x M4 |
| Casing material | Stainless-steel, brushed |
| Mass (weight) | approx. 1.7 kg (basic module)<br>approx. 0.5 kg (extension module) |

## Block diagram for basic module



**Power specifications of connections**

| Connector rail | Function | Description | Parameters |
|---|---|---|---|
| **X1** | - Power supply | Rated voltage $U_N$<br>max. total current (power) | 10 VDC ... 30 VDC<br>16 A |
| **X2** | - Proportional and/or ON/OFF outputs 0 - 9 [1]) (with high-side measuring) | $I_{min}$<br>$I_{max}$<br>Dither frequency<br>Dither amplitude (for PWM)<br>Cold resistance | 100 ... 1200 mA<br>100 ... 2200 mA<br>25 ... 200 Hz<br>0 ... 50 %<br>2 ... 35 Ohm |
| | - Frequency input | Limit frequency | $f_{lim}$ = 5 kHz |
| **X3** | - Prop. and/or ON/OFF outputs 10 - 15 | see X2 | |
| | - Digital inputs 0 - 5 | Voltage range<br>Debouncing for increasing/ decreasing signal edge can be activated separately | 10 ... 30 VDC / 5 kOhm |
| **X4** | - Auxiliary voltage 1 and 2 | Auxiliary voltage | 5, 8, 10, 12 VDC / max. 500 mA |
| **X5** | - Emergency-Stop input | Opto-decoupled | |
| | - Emergency-Stop output | Voltage range | 10 ... 30 VDC / 6 A |
| | - Relay outputs 1, 2, 3 | Voltage | 10 ... 30 VDC / 1 A |
| **X6** | - Interface CAN-Bus | | 100, 125, 250 kBaud |
| **X7** | - Interface RS232 | Interface parameter | 19.2 kBaud |
| **X8** | - Digital inputs 6, 7 | see X3 | |
| | - Analog inputs 0 - 7 (for joystick, potentiometer Parameterization, see sect. 5.1)<br>Range monitoring | 10 bit ADC ≙ 1024 steps | 4 ... 20 mA<br>0 ... 10 VDC (default) |

**Parameterization variants:**

[1]) ● The outputs 0, 2, 4, 6 etc. can be configured for double solenoids with separate $I_{min}$, $I_{max}$ values, application scenario e.g. to actuate prop. directional spool valves type PSL / PSV acc. to D 7700 ++, directional spool valves type SWS acc. to D 7951 or type HSRL acc. to D 7491.

● Simple parameter settings can be used for more efficient circuit functions for ON/OFF solenoids, (parameters, switchover time, holding current). This may be necessary for reducing the solenoid temperature at 100% ON-time and/or to increase the switching speed via over-voltage.

● Further parameter settings enable the realization of a fine adjustment range and/or operating with creeping speed at max. input signal (e.g. with joystick moved to end stop).

## 2.2 Extension module

Order examples:

**PLVC 16 - X - ABC** — Complete set with basic module acc. to sect. 2.1 and extension module with additional inputs and outputs

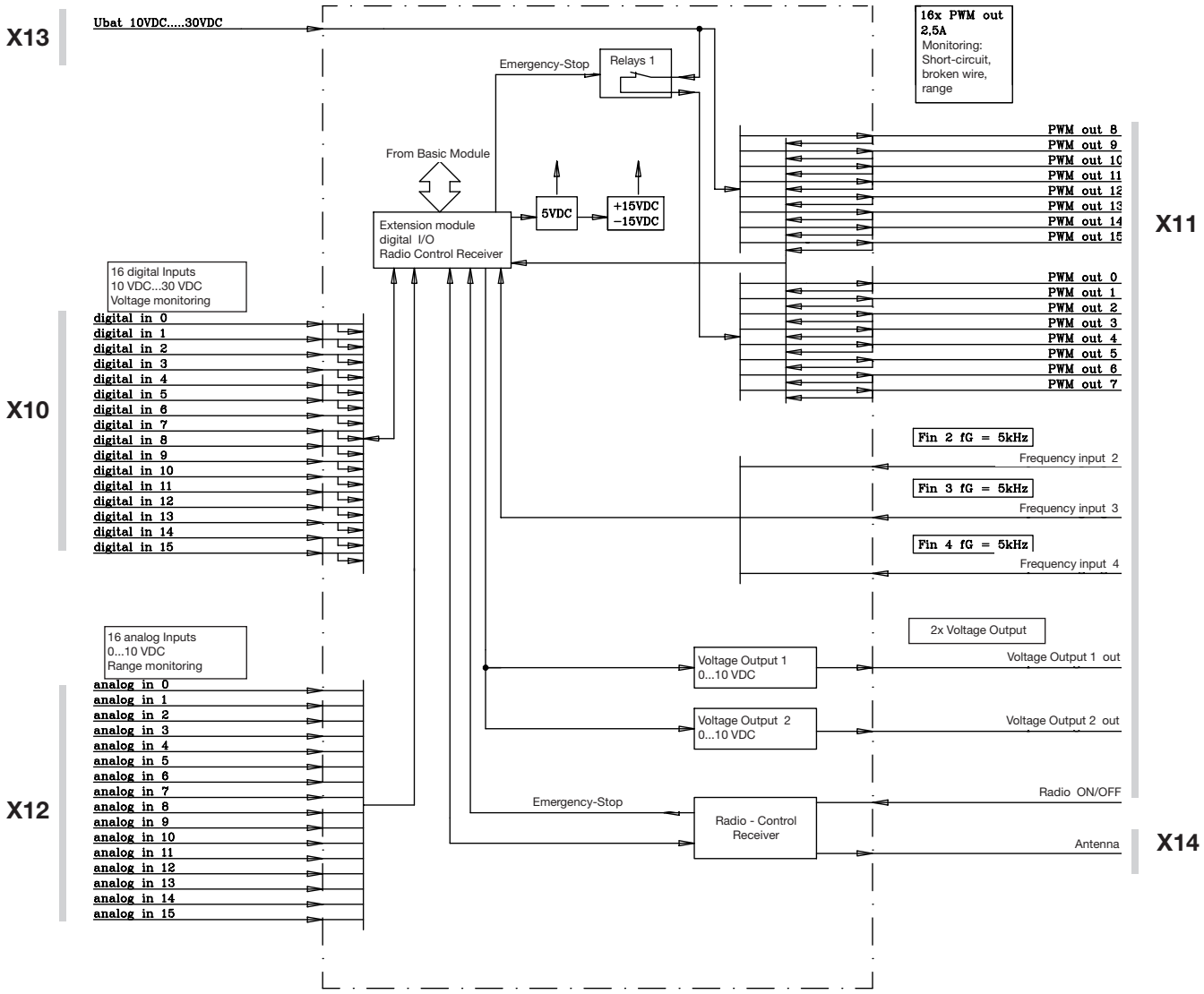
**PLVC 16 - X - ABCRNBB** — Extension with radio control (X14)

Designation extension module

**General data**

| | |
|---|---|
| Supply voltage | 10 to 30 VDC |
| Max. total current | 16 A |
| Required external fusing | 15 A (slow blow) |
| All additional data | see sect. 2.1 |
| Mounting | with 4 screws onto the basic module |

**Block diagram extension module**




**Power specifications of connections**

| Extension | Connector rail | Function | Description | Parameters |
|---|---|---|---|---|
| X | **X10** | Digital inputs 8 - 23 | Voltage range<br>Debouncing for increasing/ decreasing signal edge, can be activated separately | 10 ... 30 VDC / 5 kOhm |
| | **X11** | Digital outputs 0 - 7<br>Safety locked<br>PWM-enabled in 5% steps [1] | $I_{min}$<br>$I_{max}$<br>Cold resistance | 100 ... 1200 mA<br>100 ... 2200 mA<br>2 ... 35 Ohm |
| | | Digital outputs 8 - 15<br>PWM-enabled in 5% steps [1] | | |
| | | Frequency inputs 2, 3, 4 | Limit frequency | $f_{lim}$ = 5 kHz |
| | **X12** | Analog inputs 8 - 23 | see description X 8 (sect. 2.1) | |
| | **X13** | Power supply | see description X 1 (sect. 2.1) | |
| **R** | **X14** | Antenna socket for radio control | Coaxial connection | |

[1] without high-side measurement

## 2.3 Accessories

### 2.3.1 Plug set

The cable sets are provided for simple completion and start-up of the system

| | | |
|---|---|---|
| Order coding: | Plug set (Basic module) | Part No. 6217 2010-00 |
| | Plug set (Extension module) | Part No. 6217 2100-00 |

# 3. Software, programming, diagnosis

## 3.1 Software

The scope of delivery includes the following software package as standard:
- Operating system ("C"-programmed real-time operating system) with integrated CAN-functionality as well as PLC-capability
- Functionality of prop. amplifier for outputs 0-15 (connector rail X2, X3)
- Initializing functions for all inputs and outputs
- Diagnosis software

Available as additional options:
- Diagnosis for CAN-Bus (incl. continuous chart logger)
- Function module, adapted for specified applications (on request)

Examples:
- Max. load control
- Synchronicity / Positioning
- Position control (e.g. via option W with prop. directional spool valves type PSL(V) acc. to D 7700 ++)
- Quantity control (e.g. via current regulation valve, types SE and SEH acc. to D 7557/1)
- Pressure control (e.g. via prop. pressure limiting valves type PMV acc. to D 7485/1 and electrical pressure transducer type DT 1 acc. to D 5440 T and / or type DT 2 acc. to D 5440 T/1)

## 3.2 Programming

A distinction has to be made between two different steps of programming:
- Parameterization
  Adjusting inputs and outputs to the connected devices
- Process control (PLC-programming)
  Evaluation of incoming signals with corresponding actuation of the different outputs (including the initializing of inputs and outputs). Programming is made with the help of an PLC-software in accordance with IEC 6131-3 using instruction list (IL), function block diagram (FBD) or structured text (ST).
  This way it is possible to quickly get solutions for many applications. More complex applications may require programming in "C".
  The RS232-interface is used for loading the software into the valve control's flash memory.
  It is possible to set the parameterization during runtime.

## 3.3 Diagnosis

The following output equipment can be used for diagnosis:
- PC - connected to interface CAN-Bus (X6) or RS232 (X7), for parameterization, programming, error detection as well as remote diagnosis via modem. See also description of the "Terminal program" (acc. to B 7845 T)
- 7-segment display at the basic module,
  for on-site diagnosis (error detection)
- CAN-Bus display (see D 7845 Z),
  connected via CAN-Bus, for error detection and adjustment parameterization

## 3.4 Function blocks

General:
The manufacturer-specific function blocks serve to indicate to the PLC-programmer the interfaces to the actual system. They are structured into the following two groups.

Group 1: Initializing functions (INI functions)

These functions are used for parameterization and/or configuration of the inputs and outputs - normally only once at start-up.
It is also possible to apply this parameterization through the operating system. All these parameters and configurations are included in the system's EEPROM. Thus they are preset and can be overwritten by the PLC-system.
The terminal program (scope of delivery), allows to check , change and save (EPROM and/or file) all settings. Due to these configurations and parameterizations all data is available at runtime in an already converted and standardized form, which even can include a ramp or debouncing information. This makes it possible to write the date directly onto the outputs without conversion and supplemented with ramp information and/or other time-related information.

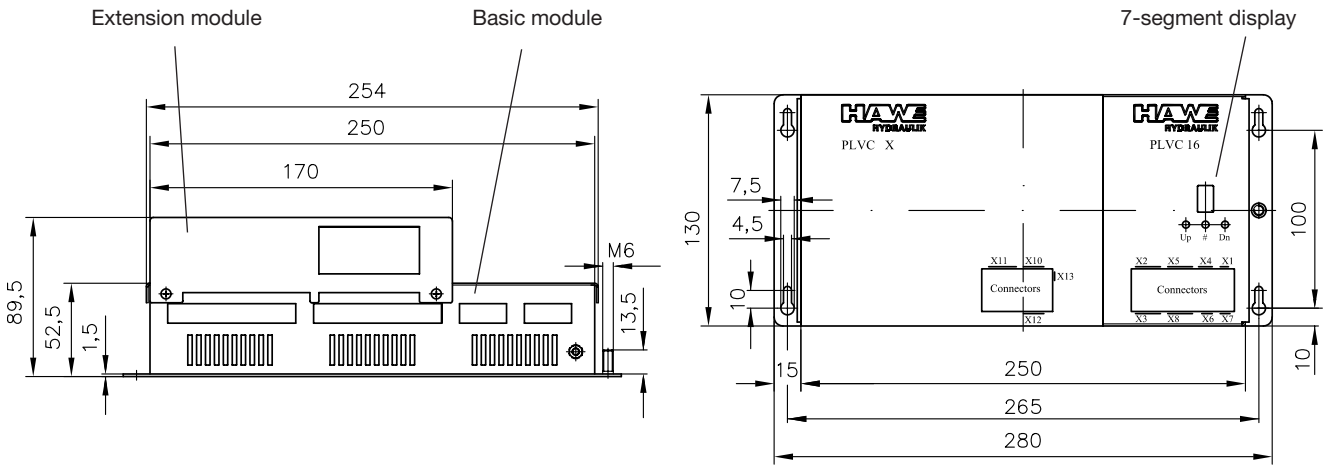
Group 2: Functions that are normally invoked cyclically during runtime (runtime module)

These functions are used to read input data, logically link them and to write them onto the outputs.

The documentation of the existing function blocks is included in the software package of the PLVC.

# 4. Dimensions

## 4.1 Basic and extension module, type PLVC 16




# 5. Appendix

## 5.1 Error message of 7-segment display

There are three keys below the display

| | |
|---|---|
| Press left key: | error number, unit of ten |
| Press right key: | error number, unit of one |

**Example: cable break at analog port 17:**

| | | |
|---|---|---|
| No key: | capital | "A" |
| Left key: | "1" | (1x10) |
| Right key: | "7" | (7x1) |
| Center key: | Additional errors are displayed if | |
| no additional errors: | "0" | |

It will return to highest priority error, when no is key pressed for 5 sec.

### Individual errors:

| | |
|---|---|
| Merely one flashing point: | No error |
| One dash in center: | No radio signal |
| Two dashes: | PLC-error |
| Three dashes: | Emergency-Stop |
| Upper-case "A": | Cable break, analog output |
| Upper-case "C": | CAN-Bus error |
| Lower-case "c": | CAN-Bus warning |
| Lower-case "d": | Undefined level (1.0 ... 3.5 V) at digital input port |
| Upper-case "F": | Radio control error |
| Upper-case "H": | Proportional valve range |
| Upper-case "P": | Proportional valve open |
| Upper-case "U": | Over-voltage |
| Lower-case "u": | Under-voltage |
| Flash-symbol, downw.: | Short-circuit at prop. valve |
| Flash-symbol, upw.: | Short-circuit at digital output or wrong connection |

## 5.2 Note

The scope of delivery for the programmable logic valve control type PLV includes an operating system and - on special agreement - a customized software. It is the duty of the customer to test the requested functionality of the PLVC as he is responsible for the faultless operation and final application of the PLVC.

**Attention:** Whenever a PLVC is replaced it is additionally necessary to order the current version of the software including the operation parameter by the manufacturer of the machine.

The customer is responsible to take care that the requested functionality and safety of the application program is fulfilled. When local laws make an approval by a notified body (testing or approval organization) necessary the customer has to apply for it.

## 5.3 Installation notes

| | |
|---|---|
| Electrical connection/ Grounding: | To guarantee the electrical interference protection of the controller, the housing must be connected to GND.<br>Ground connection has to be carried out on the shortest way between housing and machine and independent of the minus connection to the module. |
| Safety instructions: | This description is part of the unit. It contains texts and drawings concerning the correct handling of the controller and must be read before installation or use. Observe the information of the description. Non-observance of the notes, operation which is not in accordance with use as prescribed below, wrong installation or handling can result in serious harm concerning the safety of persons and plant.<br>The instructions are for authorised persons according to the EMC and low voltage guidelines. The controllers must be installed and commissioned by a skilled electrician (programmer or service technician).<br>The wiring has to comply with the respective standards and has to be galvanically separated from other circuits. The devices connected at the terminals have to be approved by HAWE Hydraulik GmbH & Co. KG and the signals fed have to comply with the specifications in this pamphlet. The device may be used in a temperature range (-40°C to +80°C). Due to the additional self-heating the housing walls can have high perceptible temperatures when touched in hot environments.<br>In case of malfunctions or uncertainties please contact the manufacturer (tech_support@hawe.de).<br>Tampering with the unit can lead to considerable risks for the safety of persons and plant. It is not permitted and leads to the exclusion of any liability and warranty claims. |
| Note: | Prior to any welding at the machine (vehicle) all PLVC-devices must be diconnected from their power supply i.e. both terminals (+ and -) respectively a potential separation (electrical isolation) must be ensured. |