Installation Manual
PQDXXA-Z01
Electronic Module for p/Q-Control of PVplus
Effective: September 01, 2013
Supersedes: September 01, 2005
Setup Manual for digital pump control module PQDXXA-Z01 to operate electro hydraulic proportional controls for PVplus.

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1. Introduction

Dimensions

Ordering Codes

**PQDXXA-Z01**
Digital control module for p/Q – control of PV series axial piston pumps, for all frame sizes

**PQDXXA-Kabel**
Programming cable to connect the control module PQDXXA-Z01 with a PC via a RS232C Interface (not included in module)

**PQDXXA-Kabel-USB**
Programming cable to connect the control module PQDXXA-Z01 with a PC via a USB Interface (RS232C protocol, not included in module)
Name plates

Type: PQDXXA-Z01

Bitte Betriebsanleitung beachten
Please refer to the manual

Made in Germany
40982815 PQDXX

Date Code
40982816 PQDXX
Serial number

digital signal
analog signals
Digital Pump Control Module
Series PQDXXA-Z01
Installation and Setup Manual
Bulletin HY30-3251-INST/UK
Parker Hannifin Manufacturing Germany GmbH & Co. KG
Pump and Motor Division
Chemnitz, Germany

Parker digital control modules series PQDXXA-Z01 for snap track mounting are compact, quickly installed and easy to connect with plug-in PIN blocks. The digital concept offers perfect reproducibility and optimized adaption to all PVplus pump displacements and all possible functions from a simple displacement control to a closed loop pressure control with horse power limitation by an easy to use setup software.

Features:
- Digital control circuit
- Adjustable control circuits for pump displacement and compensating pressure
- Constant solenoid current control
- Analog input commands
- Diagnosis output for displacement and pressure (if pressure transducer installed)
- Individual adjustable ramp function for displacement and pressure
- Enable input for solenoid power amplifier stage
- Status monitor
- Parameter setting via data cable with RS-232 interface and R232C or USB adapter
- Electrical connection via plug-in PIN blocks
- Compatible to the relevant European EMC specifications
- Easy to use PC based setup software
- Covers all displacements from 16 to 360 cm³/rev
- Covers all functions: displacement control, displacement control with open loop pressure control, displacement control with closed loop pressure control. Horse power control or horse power limitation respectively, is active with an installed pressure transducer.
## Technical Data

<table>
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<tr>
<th>General</th>
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<tbody>
<tr>
<td>mounting</td>
<td>Snap-On Module according EN 50022</td>
</tr>
<tr>
<td>housing material</td>
<td>Polyamid PA6.6</td>
</tr>
<tr>
<td>inflammation class</td>
<td>V0 according UL 94</td>
</tr>
<tr>
<td>mounting position</td>
<td>any</td>
</tr>
<tr>
<td>environmental temperature range °C</td>
<td>-20...+55</td>
</tr>
<tr>
<td>storage temperature °C</td>
<td>-20...+70</td>
</tr>
<tr>
<td>protection class</td>
<td>IP 20 according DIN 40050</td>
</tr>
<tr>
<td>mass g</td>
<td>260</td>
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<table>
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<th>Electrical</th>
<th></th>
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<tr>
<td>duty cycle ED %</td>
<td>100</td>
</tr>
<tr>
<td>supply voltage U_s VDC</td>
<td>18...30, ripple &lt; 5% eff., surge free</td>
</tr>
<tr>
<td>rush in current peak, typ. A</td>
<td>22 for 0,2 ms</td>
</tr>
<tr>
<td>current consumption, max. A</td>
<td>&lt; 2,0 for displacement control</td>
</tr>
<tr>
<td></td>
<td>&lt; 4,0 for p/Q-control</td>
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<tr>
<td>Supply line fuse A</td>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>I_c mA +4...+20, ripple &lt; 0,01 % eff., surge free, R_i = 250 Ω (pressure command only)</td>
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<tr>
<td>Resolution of input command %</td>
<td>&lt;0.025, Horse Power control &lt; 0.025</td>
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<td>Digital Inputs U_f V</td>
<td>Logic 0: &lt;2</td>
</tr>
<tr>
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<td>Logic1: &gt;10 (and &lt;30)</td>
</tr>
<tr>
<td></td>
<td>Input resistance R_i = 25 kΩ</td>
</tr>
<tr>
<td>Digital Inputs U_st V</td>
<td>Logic 0: &lt;2</td>
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<td></td>
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<td>7x4 pol. connection blocks, screw PINs 0.2...2.5 mm², plug-in style</td>
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<td></td>
<td>RS232C: 3.5mm JISC-6560</td>
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<td></td>
<td>PE: via DIN rail</td>
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<tr>
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<td>RS232C oder USB</td>
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<tr>
<td>EMC</td>
<td>EN61000-6-2: 8/2002</td>
</tr>
<tr>
<td></td>
<td>EN61000-6-3: 6/2005</td>
</tr>
<tr>
<td>Connection cable mm²</td>
<td>1.5 (AWG16) overall braid shield, for supply and solenoid cables</td>
</tr>
<tr>
<td></td>
<td>0.5 (AWG 20) overall braid shield, for sensors and commands</td>
</tr>
<tr>
<td>cable length max. m</td>
<td>50</td>
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</table>
2. Security advice
Please read and follow this installation and setup manual before installation, setup, start up, service, repair and storage! Failure to follow the instructions herein can cause severe damage to the electronic or to the connected system.

Symbols
This manual makes use of symbols, which have to be followed according to their meaning:

⚠️ Remarks with regard to warranty
⚠️ Remarks with regard to possible damage to the electronic module or to any connected pump or part of the system
👉 Helpful additional instructions

Name plates, markings
Information direct attached to the module like connecting diagrams and name plates are to be kept in readable condition.

Work at the electronic
Workings in the area of installation and commissioning of the electronic may only be allowed by qualified personnel. This means persons which have, because of education, experience and instruction, sufficient knowledge on relevant directives and approved technical rules.

3. Important notes
Intended usage
This operation manual is valid for module electronics PQDXXA-Z01 series. Any different or usage beyond it is deemed to be as not intended. The manufacturer is not liable for warranty claims resulting from this.

General instructions
We reserve the right for technical modifications of the described product. Illustrations and drawings within this manual are simplified representations. Due to further development, improvement and modification of the product the illustrations might not match precisely with the described unit. The technical specifications and dimensions are not binding. No claim may result out of it. Copyrights are reserved.

Liability
The manufacturer does not assume liability for damage due to the following failures:
- incorrect mounting / installation
- improper handling and operation
- lack of maintenance
- operation outside the specifications

Storage
In case of temporary storage the electronic must be protected against contamination, atmospheric exposure and mechanical damages.

4. Mounting / Installation
Scope of Supply
⚠️ Please check at receiving the shipment for damages due to shipping. Report damages immediately to the carrier, the insurance company and the supplier!

👉 The programming cable (only for setup needed) is not part of the module shipment and has to be ordered separately.

Mounting
- compare electronic module type (see ordering code on name plate) with the parts list respectively the circuit diagram
- the module may be mounted in any orientation
- for mounting an assembly rail according to EN 50022 is required

Mounting rail dimensions:
Installation and removal of module from the rail

Mounting: 1. bring the module in contact with the upper edge of the rail
2. flip the module downward until it snaps into/on the rail

Removing: 1. use a screw driver (approx. 4 x 1 mm blade) to lift metal socket
2. flip the module upwards and remove it from rail

Operating limits
The electronic module may be operated within the specified limits only. Please refer to the „technical data“ section.

- Follow the environmental conditions! Extreme temperatures, shock load, moisture, radiation, illegal electromagnetic emissions may result in malfunction and other operating issues. Follow the limitations listed in the „specifications“ table

Electrical Connection
The module is connected to power supply, machine control and to pump /valves with plug-in PIN screw blocks.

- This easy-to-install connection allows a fast module replacement.

The connecting wires need to match the specification below:

- Wire type: hook up cable, stranded
- Cross section: supply voltage, solenoids: min. AWG 16 / 1.5 mm²
- sensors, commands: min. AWG 20 / 0.5 mm²
- Wire length: max. 50 m

- for wire length > 50 m please consult the factory

Wire skinning:

The screw terminals are designed to connect to all kinds of copper wires without the need for specific preparation. To protect stranded wires the use of end sleeves is possible.

- Soldering of the connecting wires is not permitted.

To ensure EMC compatibility the connections partly have to be shielded. See details in the „Electrical Interfacing“ section.

- The installation must be performed by qualified personnel only. A electrical short between individual connectors, loose wires as well as improper shielding can result in malfunction of electronic or pump and in irreparable destruction of control module.

- The pump has to have a direct connection to the earth grounded machine frame. Earth ground connection of the mounting rail and the cable shields have to be connected to the control unit earth ground terminal. Machine frame and control unit must be connected with a low resistance connection to avoid ground loops.

Electrical Interfacing

Supply Voltage
The supply voltage has to be connected to PINs 3 and 4 and to PINs 22 and 24. The supply voltage must be higher than 18 V to avoid sensor malfunction and lower than 30 V to avoid overheating and destruction of the module. The residual ripple may not exceed 5%.

- The power supply must comply with the relevant standards (e.g. DIN EN 61 558) and must carry a CE mark. The supply voltage must be free of inductive surges.

- Please consider the high inrush current when selecting the power supply (see specification). Power supplies with current limiting features may cause problems during energizing the unit.

- The function of the module is blocked, when supply voltage polarity is wrong.

- Each module requires a preliminary fuse of 5 A, medium lag. Without fuse irreparable damage to the module or the pump control is possible.
Wiring diagram
Digital Inputs

Enable

A positive voltage higher than 10 V (and < 30 V) at PIN 8 enables the solenoid current driver circuit of the module. The operation of the module requires a permanent signal on PIN 8 (e.g. supply voltage). Disconnecting the enable signal or a signal level below 2.5 V will immediately switch off the solenoid current. Ramp settings will not apply.

⚠️ The enable function is not a safety function to avoid unwanted operation of the machine in terms of machine safety regulations.

Enable p/Q-control

A positive signal > 10 V (and < 30 V) at PIN 7 enables the pressure control function of the module. A signal lower than 2.5 V at PIN 7 will allow the module to perform displacement control of the pump only. p-valve solenoid current is set to maximum.

Enable ramp

A positive signal > 10 V (and < 30 V) at PIN 5 enables the internal ramp generator. The module offers an individual ramp-up and ramp-down function for displacement and pressure command. This ramp function allows ramp settings up to 60 s. A signal lower than 2.5 V at PIN 5 will disable the ramp generation.

⚠️ For emergency shut off the ramp function should be disabled in order to achieve a fast down stroking of the pump.

⚠️ Ramp function should be used for lasting system stability.

Analog Inputs

Displacement command signal input

The displacement command is connected to PIN 10.

⚠️ Please note: all input commands as well as all output signals are referenced to the modules 0 V level at PIN 9, 11 and 31.

A +10 V input command at PIN 10 brings the pump to full displacement, when module settings and pump size are matched. A 0 V input command at PIN 10 brings the pump to dead head (0 l/min output flow), when the pressure at the pump outlet is 20 bar or higher.

With the MAX setting for the displacement command (Parameter: MAX:WQ) a smaller displacement than the nominal pump displacement at +10 V input command can be adjusted.

⚠️ If the hydraulic system is not able to maintain a pump outlet pressure of 20 bar at pump dead head, pre-load valve must be installed, to maintain controllability of the pump displacement.

⚠️ To prevent malfunction and erratic control response a high signal quality is recommended. The command signal needs to be filtered and must be free of inductive surges and modulations.

⚠️ Incorrect signal levels will lead to erratic control function and may damage the unit. For correct signal levels see technical data section.

⚠️ It is recommended to use shielded cables with a cross section of at least 0.5 mm² for the input command lines, to avoid interference with power lines or other sources for electromagnetic "noise".
**Pressure command signal input**

The pressure command is connected to PIN 13. A +10 V input command brings the pump to the nominal pump pressure (350 bar for PV series pumps), if the pressure compensator differential setting is set in the module software and the pilot valve is the recommended type PVACRE***35 (* represents the mounting bolt options, thread options and the sealing options). A 0 V input command brings the pump to minimum compensating pressure (typical differential pressure + ca. 5 bar). The relation between input command and compensating pressure is linearized for the pressure control (open loop, TYPE=P). With a pressure transducer installed in the pilot circuit (at the pressure pilot valve PVAC***35) the compensating pressure is closed loop monitored (TYPE=Q). With the MAX setting for the pressure command (Parameter MAX:WP) a smaller pressure at +10 V input command can be adjusted.

⚠️ To enable the pump to control pressures up to 350 bar the displacement command has to be at least 15%.

⚠️ To prevent malfunction and erratic control response a high signal quality is recommended. The command signal needs to be filtered and must be free of inductive surges and modulations.

⚠️ Incorrect signal levels will lead to erratic control function and may damage the unit. Please see the section technical data.

**Horse power command signal input**

The horse power command is connected to PIN 29. A +10 V input command allows the pump to operate within its full power range (nominal displacement resp. flow, 350 bar output pressure). If the module is programmed for electronic horse power limitation (Parameter: PL:EXT = EXT) a reduced input command at PIN 29 will result in a limitation of the pump output flow, if the maximum power is exceeded. The maximum pump driving power is calculated and stored internally in the module. The overall pump efficiency is considered in this calculation. A second maximum or limit can be set with the power limitation parameter (PL:PL) which can be less or equal to the calculated value.

If the external power limitation is deactivated (Parameter: PL:EXT = INT), the power limitation parameter defined in (Parameter: PL:PL) acts as boundary (only if a pressure sensor is installed). This will keep the horse power requirement of the pump below the commanded level.

![Tip icon] A +5 V input command signal will limit the horse power requirement for the pump to 50% of the full nominal horse power (i.e. for PV028 the full corner horse power at 1,500 rpm is approx. 29.0 kW, at +5 V input command at PIN 29 the pump input power is limited to 14.5 kW).

![Tip icon] Only for a constant input speed this control maintains a certain horse power level. For variable speed only the max. input torque level is controlled.
Sensor signals

Displacement Transducer (cable 1)

The displacement transducer (LVDT) must be connected to the power supply (LVDT connector PIN 2 to +24 V), to the displacement signal input (LVDT connector PIN 1 to module PIN 6) and to the module 0 V (LVDT connector PIN 3 to module PIN 9 / 11).

The displacement transducer signal is 9 V, when the pump is at dead head and between 7.5 and 4 V (depending on frame size and nominal displacement) at full stroke. The connection to the displacement transducer is checked by the modules cable break monitoring.

A sensor signal below 1 V will lead to a shut off of the power amplifier stages and will force the pump to dead head.

The LVDT connector has to be assembled carefully to avoid the danger of a short circuit in the connector (i.e. the exact position of the lagging ring is to be checked). A electrical short in the connector can cause irreparable damage to the electronic module.

Some electronics supply companies offer pre-fabricated cables with the M12x1 connector molded to the cable. These cables avoid the risk of mis-assembly, offer a higher protection against ingestion of moisture or oil and are available in many different length options.

Please note that the displacement signal is a voltage signal and the voltage drop is proportional to the cable length. The length of the cable should only be as long as necessary.

cable 1: 4 x 0.5 mm², shielded, max. 50 m long
connector: round type M12 x 1; 5-PIN angled version
Pressure Transducer (cable 2)

A pressure transducer is only needed, when the module is set to closed loop pressure control (TYPE = Q) or if the circuit requires a internal or external horse power control. The pressure transducer must be connected to the power supply (connector PIN 3 to +24 V), to the pressure transducer signal input (connector PIN 1 to module PIN 14) and to the module 0 V level (connector PIN 2 to module PIN 9 / 11). The pressure transducer signal is between 4 mA (current signal) at 0 bar and 20 mA at the transducers nominal pressure of 600 bar. The normal working range in case of a PV series pump is 4...11.67 mA. The connection to the pressure transducer is checked by the modules cable break monitoring. A current below 3 mA will lead to a shut off of the power amplifier stages and will force the pump to dead head.

The pressure transducer signal is between 4 mA (current signal) at 0 bar and 20 mA at the transducers nominal pressure of 600 bar. The normal working range in case of a PV series pump is 4...11.67 mA. The connection to the pressure transducer is checked by the modules cable break monitoring. A current below 3 mA will lead to a shut off of the power amplifier stages and will force the pump to dead head.
Soloid Connections

Displacement control valve solenoid (cable 3)
The displacement control valve (Q-valve) solenoid must be connected to PIN 18 (connector PIN 1) and PIN 20 (connector PIN 2) of the control module. The module supplies a current between 0 and 1.3 A to the solenoid. The nominal current in a constant displacement control situation is in the range of 720 to 750 mA, to operate at half of the solenoids nominal force.

Pressure pilot valve solenoid (cable 4)
The pressure pilot valve (p-valve) solenoid must be connected to PIN 17 (connector PIN 1) and PIN 19 (connector PIN 2) of the control module. The module supplies a current between 0 and 1.3 A to the solenoid.

cable 2, 3: 3 x 1.5 mm², max. 50 m long
connector: according DIN 43 650, version AF, 3-PIN protection class IP 65 for voltages up to 250V
Analog Outputs

Diagnosis displacement
PIN 15 provides an analog readout proportional for the actual pump displacement. The signal is +10 V at full stroke and 0 V at dead head and stand-by pressure, if the LVDT adjustment is correct and the programming of the module matches the actual pump size and displacement. The maximum current load to this output is 10 mA.

Diagnosis pressure
PIN 16 provides an analog readout for the actual pressure, when a pressure transducer is installed and the module is programmed for closed loop pressure control. The signal is +10 V at nominal pressure (350 bar) and 0 V at 0 bar pump outlet pressure. The maximum current load to this output is 10 mA.

Reference voltage output
PIN 12 provides a stabilized +10 V reference signal, which can be used to drive potentiometers for the analog input signals. The maximum current load for the reference output is 10 mA.

Digital outputs

Ready
The Ready output (PIN 1) gives information on the module being ready to operate. A signal larger than +10 V signals a logic 1, a signal lower than +2 V signals a logic 0. PIN 1 has a logic 1 signal, when all necessary sensors are attached and intact and the Enable signal is set (logic 1 at PIN 5). The control loop is closed under these conditions. The Ready LED (green) is lighted.

When a sensor fault occurs (cable broken, no sensor connected, signal out of range, wrong pump size selected) a logic 0 is sent. The Ready LED starts flashing.

Status
The Status output (PIN 2) gives information on the activity of the horse power control. A signal larger than +10 V signals a logic 1, a signal lower than +2 V signals a logic 0.

If the horse power control is active, which means that the displacement is actively driven by the horse power controller, the Status signals a logic 1. The Status LED (yellow) is lighted.

Is the total input power within the specified corner power the Status signal is a logic 0. The Status LED is off.

During fast control actions the Status LED will flicker.

Module status depending on digital inputs:

<table>
<thead>
<tr>
<th>ENABLE</th>
<th>PQ</th>
<th>RAMPE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>off (0)</td>
<td>-</td>
<td>-</td>
<td>System not active, analog outputs switched off, READY signal is off (0). Control loop not closed.</td>
</tr>
<tr>
<td>on (1)</td>
<td>off (0)</td>
<td>-</td>
<td>System active, displacement control loop closed, READY signal is on (1). Pressure control loop is not active.</td>
</tr>
<tr>
<td>on (1)</td>
<td>on (1)</td>
<td>-</td>
<td>System active, displacement control loop closed, READY signal is on (1). Pressure control loop is active.</td>
</tr>
<tr>
<td>on (1)</td>
<td>-</td>
<td>on (1)</td>
<td>System active, displacement control loop closed, READY signal is on (1), Ramps for displacement commands and pressure command are activated.</td>
</tr>
</tbody>
</table>
5. Programming

The Programming of the p/Q-module can be done in an easy way. For programming the module must be connected with the PC via a programming cable (Ordering number PQDXXA-Kabel or PQDXXA-Kabel-USB).

The ProPVplus Software need to be installed and started on the connected computer to get the module parameterized. The program runs under WINDOWS XP, WINDOWS VISTA, WINDOWS 7 and WINDOWS 8.

The latest version can be downloaded at: http://www.parker.com/euro_pmd → Support → Toolbox

The PQDXXA-Z01 module is compatible to ProPVplus 3.3.0 upwards.

Please note that the data format has been changed from .PAR to .WPC. Old .PAR parameter sets cannot be translated to the new data format.

The software offers the following features:

The PARAMETER LIST displays all available and changeable parameter. Two different input levels are available (MODE = STD or EXP). An input dialog opens after double clicking on the parameter. Limits of the input are shown, faulty or wrong inputs are identified. All parameters are directly send to the module, if it is in active mode, which means ProPVplus is connected with the module [CONNECT]. Parameter sets can also be edited offline without any connection to the module.

The MONITOR window allows the numerically display of various process parameters.

The OSCILLOSCOPE displays various process parameters as graphs. The Oscilloscope offers furthermore a Start-Stop option and allows the data export as well as the storage as text file (.txt). The cursor function in the right mouse button menu provides the option for amplitude and time measurements.

Please see the documentation in the software ProPVplus under Menu → Help for further information about the handling of ProPVplus.

When starting ProPVPlus the below mentioned screen will be displayed:
Terms for the oscilloscope- and monitor view:

- **WQ** Displacement command – Cmd Q
- **XQ** Displacement actual value – Actual Q
- **UQ** Correcting variable displacement control - Output Q
- **IQ** Current to the displacement control valve

- **WP** Pressure command – Cmd p
- **XP** Pressure actual value – Actual p
- **UP** Correcting variable pressure control – Output p (only if pressure transducer is installed)
- **IP** Current to the pressure control valve

- **WL** Horse power command – Cmd L
- **XL** Horse power actual value – Actual L

All Parameters are displayed with a resolution of 0.01. Please mind the units.

Parameters shown in the Oscilloscope are sampled with 1ms. The solenoid current has a lower sampling rate. Please take the solenoid display only informative and do not take these values for a quantitative validation.

Do not start up a pump or hydraulic system before loading the correct control program for the particular pump size to the attached module. Damage of the pump or components connected to it can be the results.
6. Operating Parameters

Latest parameter sets are available for download at:

Selection of help text language:
Parameter LG DE = German, Display of help texts and parameter descriptions in German.
EN = English, Display of help texts and parameter descriptions in English.

The module need to be re-identified (IDENTIFY ) after changing this parameter.

Selection of security level:
Parameter MODE STD = Standard, All parameters for a first start up are shown.
EXP = Expert, Parameter for further settings and the control system optimization are shown additionally to the standard parameter list.

6.1 MODE – Standard (STD)

Selection of pump displacement:
Parameter PVSEL 016, 020, 023, 028, 032, 040, 046, 063, 080, 092, 140, 180, 270, 360 or CUSTOM (additional parameterizable data set).

The base parameter for the control circuit are loaded according to the PVSEL parameter.

PVSEL needs to be adjusted first because various parameters are set according to this selection. Otherwise other parameter changes might have no effect.

Selection of control type:
Parameter TYPE F, P, Q
F = Displacement control
P = Displacement control with open loop pressure control
Q = Displacement control with closed loop pressure control

Setting of horse power control:
Parameter PL:PL Selection of horse power control in 0,1 kW. The parameter is freely selectable, where the upper limit equals the pumps maximum input power which is calculated module internally. The lower limit equals 10% of the pumps maximum input power.

The rotational speed of the drive motor is used for the calculation of the pumps maximum input power. Please mind the correct adjustment. The standard adjustment of the parameter PL:RPM is set to 1500rpm.
Setting of LVDT parameter:
Parameter  MIN:XQ  Displacement sensor feed back at dead head (LVDT-0%) in mV.
          MAX:XQ  Displacement sensor feed back at full stroke (LVDT-100%) in mV.

Both parameters are shown at the pump enclosed tag.

Pumps are tested at a fluid temperature of (50±2)°C. Small deviation of the LVDT parameters are possible if the hydraulic system temperature where the pump is used is significant different. In this case, the values need to be re-measured with a convenient voltmeter and redefined in the software.

6.2 MODE – EXPERT (EXP)
Setting of pressure sensor end range
Parameter  P_SENSOR  Setting of pressure sensor end range in bar. This parameter is base for the scaling of the sensor with the parameter P_NOMINAL.

P_SENSOR is by default set to 600 bar.

Setting of pressure sensor scaling:
Parameter  P_NOMINAL  Setting of pressure sensor scaling in bar. This parameter determines the upper limit for the pressure sensor signal.

Changing this parameter may cause negative effects to your system. A new adjustment of the pressure valve solenoid limitation (Parameter CP:MINV and CP:MAXV) might be necessary!

In case of running the pump with a PVACRE*42 as pilot pressure valve, this parameter has to be set to 420 bar. A new adjustment of the pressure valve solenoid limitation (Parameter CP:MINV and CP:MAXV) might be necessary!

The parameter P:NOMINAL shall match the pressure pilots end range.

Setting of the compensators differential pressure:
Parameter  P_CORR  Setting of the differential pressure in bar. The factory setting of the compensator differential pressure and the software is 15bar.

Selection of horse power mode:
Parameter  PL:EXT  INT = The setting in PL:PL is getting active as horse power limitation. EXT = The horse power control gets dynamic by an analog +10 V Signal at PIN 29 while the setting at PL:PL gets 100% (maximum value) for the scaling

The horse power control is only active if a pressure sensor is installed.
Setting of the rotational speed:
Parameter PL:RPM Setting of pumps or drive motors rotational speed respectively.

The parameter is used for the maximum input power calculation.

Setting of the horse power controls delay element:
Parameter PL:T1 Setting the horse power controls delay element. The time between signal input and signal output of the horse power controlled subsystem can be modified with that parameter.

This parameter should be changed only if the controlled system tends to instabilities because of high dynamic challenges.

When the module is operated in horse power control mode under certain conditions and at fast pressure rise rates the power limiter may act too slow and the horse power requirements exceed the limits shortly.

Setting of volumetric efficiency correction:
Parameter Q:CORR This parameter describes the compensation of the pumps volumetric efficiency and builds a linear correction function vs. pressure which output is added to the Q-command signal. The Q-controls variable limitation is thereby still 100%.

![Illustration Q:CORR, η_vol vs. p](chart.png)

The usage of ramp functions (Parameter AQ:UP, AQ:DOWN) is recommended.
Setting of the Sensor monitoring:

Parameter SENS

ON = Sensor monitoring is activated. Reset has to be done manually.
OFF = Sensor monitoring is deactivated.
AUTO = Sensor monitoring is activated. The module gets automatically reset after the failure or the defect is corrected. A manual reset is not necessary.

The manual reset is done by switching the ENABLE signal at PIN 8.

The module monitors signals from the displacement sensor as well as from the pressure sensor according to a specified range and the electric circuit to the valve magnets. Signals out of the specified range (pressure sensor < 3 mA, displacement < 1 V) or an opened electric circuit (broken cable detection) are detected as failure. The module will force the pump to dead head. The green READY LED is flashing.

The Sensor monitoring is depending of the control type selection. The displacement sensor is monitored at all control types (F, P, Q). The pressure sensor is only monitored at control type Q. When choosing control type F and P, the parameter AIN:WP is automatically set to voltage signal and is therewith out of the sensor monitoring. If a pressure sensor installed in the system, which should be used for the horse power control, the pressure sensor signal type (AIN:WP) needs to be set back manually at control type F and P.

Setting of the displacement command scaling:

Parameter MIN:WQ Setting of the lower limit of the internal displacement command signal.
MAX:WQ Setting of the upper limit of the internal displacement command signal.

MIN:WQ and MAX:WQ can be used to set a minimum displacement respectively a maximum displacement without changing the command signal resolution 0-10 V.
Setting of ramp times - displacement control:

Parameter AQ:UP  Ramp time settings for rising displacement commands in ms.
AQ:DOWN  Ramp time settings for dropping displacement commands in ms.

It is recommended to activate ramps to achieve sustainable system stability. Ramps can be activated with a +24 V signal at RAMP ON (PIN 5).

Ramp times in the software refer to a command step of 100% and define the ramp gradient. Ramp times are proportional to the percentage of the command steps.

Default ramp times – recommended ramp times for displacement control:

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Pump displacement [cm³/rev]</th>
<th>System pressure [bar]</th>
<th>Ramp time [ms] Rising command signals</th>
<th>Ramp time [ms] Dropping command signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>350</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>350</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>350</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>1</td>
<td>28</td>
<td>350</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>350</td>
<td>80</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>350</td>
<td>80</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>46</td>
<td>350</td>
<td>80</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>63</td>
<td>350</td>
<td>120</td>
<td>110</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>350</td>
<td>120</td>
<td>110</td>
</tr>
<tr>
<td>3</td>
<td>92</td>
<td>350</td>
<td>120</td>
<td>110</td>
</tr>
<tr>
<td>4</td>
<td>140</td>
<td>350</td>
<td>135</td>
<td>165</td>
</tr>
<tr>
<td>4</td>
<td>180</td>
<td>350</td>
<td>170</td>
<td>175</td>
</tr>
<tr>
<td>5</td>
<td>270</td>
<td>350</td>
<td>195</td>
<td>185</td>
</tr>
<tr>
<td>6</td>
<td>360</td>
<td>350</td>
<td>225</td>
<td>245</td>
</tr>
</tbody>
</table>

Setting of the pressure command scaling:

Parameter MIN:WP  Setting of the lower limit of the internal pressure command signal.
MAX:WP  Setting of the upper limit of the internal pressure command signal.

MIN:WP and MAX:WP WQ can be used to set a minimum pressure respectively a maximum pressure without changing the command signal resolution 0-10 V.

Setting of the pressure sensor signal type:

Parameter AIN:WP  The pressure sensor input evaluate current as well as voltages.

Default setting is the evaluation of current signals

 Voltages at PIN 14 are not monitored by the broken cable (SENS) detection.
Setting of ramp times – pressure control:

Parameter AP:UP  Ramp time settings for rising pressure command signals in ms.
AP:DOWN  Ramp time settings for dropping pressure command signals in ms.

- It is recommended to activate ramps to achieve sustainable system stability. Ramps can be activated with a +24 V signal at RAMP ON (PIN 5).

- Ramp times in the software refer to a command step of 100% and define the ramp gradient. Ramp times are proportional to the percentage of the command steps.

- The optimal ramp time setting is for pressure control depending on the system, it is especially depending on the hydraulic capacities and the different operating points. The set-up at the specific system may help to optimize the pressure control.

Setting of control parameter – displacement control:

Parameter CQ:P  Gain setting of P action in 0,01 units.
CQ:I  Gain setting of I action in 0,1ms.

- I action is deactivated with input 0.

CQ:D  D action factor (time factor for differentiation) in 0,1ms.

Setting of control parameter – pressure control:

Parameter CP:P  Gain setting of P action in 0,01 units.
CP:I  Gain setting of I action in 0,1ms.

- I action is deactivated with input 0.

CP:D  D action factor (time factor for the differentiation) in 0,1ms.
CP:T1  Filter for the D Action of the closed loop pressure control in 0,1ms.

- The PID parameter tuning will help to optimize the hydraulic system.

Setting of the trigger threshold – pressure control:

Parameter CP:MINV  Trigger threshold of pressure control valve in mA.

Setting of nominal current - pressure valve:

Parameter CP:MAXV  Nominal current of the pressure control valve in mA.

- It might be necessary to reset the trigger threshold CP:MINV and the nominal current CP:MAXV to get optimal results in open loop pressure control.
6.3. Important settings and diagnosis values

### Settings- / diagnosis values

<table>
<thead>
<tr>
<th>Size/Code</th>
<th>max. displacement [cm³/rev.]</th>
<th>Diagnosis signal $V_{G_{\text{max}}} \ [\text{Volt} \ _{-0.5}]$</th>
<th>LVDT signal $V_{G_{\text{max}}} \ [\text{Volt} \ _{±0.25}]$</th>
<th>Diagnosis signal $V_{G_{\text{min}}} \ [\text{Volt}]$</th>
<th>LVDT signal $V_{G_{\text{min}}} \ [\text{Volt} \ _{±0.25}]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV016</td>
<td>16</td>
<td>10.0</td>
<td>6.34</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV020</td>
<td>20</td>
<td>10.0</td>
<td>6.06</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV023</td>
<td>23</td>
<td>10.0</td>
<td>5.87</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV028</td>
<td>28</td>
<td>10.0</td>
<td>5.50</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV032</td>
<td>32</td>
<td>10.0</td>
<td>6.40</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV040</td>
<td>40</td>
<td>10.0</td>
<td>5.70</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV046</td>
<td>46</td>
<td>10.0</td>
<td>5.43</td>
<td>0.0</td>
<td>7.5</td>
</tr>
<tr>
<td>PV063</td>
<td>63</td>
<td>10.0</td>
<td>7.12</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>PV080</td>
<td>80</td>
<td>10.0</td>
<td>6.48</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>PV092</td>
<td>92</td>
<td>10.0</td>
<td>6.10</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>PV140</td>
<td>140</td>
<td>10.0</td>
<td>5.24</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>PV180</td>
<td>180</td>
<td>10.0</td>
<td>3.83</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>PV270</td>
<td>270</td>
<td>10.0</td>
<td>4.06</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>PV360</td>
<td>360</td>
<td>10.0</td>
<td>4.06</td>
<td>0.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

### Max. Horse power and according horse power command

<table>
<thead>
<tr>
<th>Size/Code</th>
<th>@350bar @1500 rpm [kW]</th>
<th>Command for max. power [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV016</td>
<td>16.4</td>
<td>10.0</td>
</tr>
<tr>
<td>PV020</td>
<td>20.9</td>
<td>10.0</td>
</tr>
<tr>
<td>PV023</td>
<td>23.8</td>
<td>10.0</td>
</tr>
<tr>
<td>PV028</td>
<td>29.0</td>
<td>10.0</td>
</tr>
<tr>
<td>PV032</td>
<td>33.1</td>
<td>10.0</td>
</tr>
<tr>
<td>PV040</td>
<td>39.8</td>
<td>10.0</td>
</tr>
<tr>
<td>PV046</td>
<td>46.1</td>
<td>10.0</td>
</tr>
<tr>
<td>PV063</td>
<td>62.1</td>
<td>10.0</td>
</tr>
<tr>
<td>PV080</td>
<td>75.5</td>
<td>10.0</td>
</tr>
<tr>
<td>PV092</td>
<td>86.9</td>
<td>10.0</td>
</tr>
<tr>
<td>PV140</td>
<td>133.0</td>
<td>10.0</td>
</tr>
<tr>
<td>PV180</td>
<td>168.8</td>
<td>10.0</td>
</tr>
<tr>
<td>PV270</td>
<td>247.0</td>
<td>10.0</td>
</tr>
<tr>
<td>PV360</td>
<td>331.2</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**Calculation example for the external command:**

A PV028 is driven with an input horse power of 15.0kW. Maximum horse power is 29.0kW (PL:PL = 290). The voltage command input according to this input horse power is 10.0V as shown in the table left side.

To adjust a horse power limit of 15.0 kW a command voltage of:

$$15.0 \, \text{kW} / 29.0 \, \text{kW} \times 10.0 \, \text{V} = 5.2 \, \text{V}$$

need to be set at PIN 29.
7. Connecting diagram for proportional displacement control; code ...FPV.
(cable details see page 13 to 15)

- Displacement cmd. (Q_cmd) 0...10V
- Connect to terminal 11, 0V
- Displacement transducer, 4...9V
- 0V
- Enable ramp, 24V nominal
- Enable power amplifier, 24V nominal
- 10V reference output
- Diagnosis, displacement, 0...10V
- Ready, 24V nominal
- Status, 24V nominal

Cable 1 from LVDT

Displacement control valve, code PVCF*PV**

Cable 3 to proportional solenoid

Flow Q

Pressure p
8. Connecting diagram for p/Q-control; Codes ..UPR, ...UPK, ...UPM, ...UPS, ...UPQ, ...UPP and ...UPF.

- Displacement control stage, code PVCM*PV**
- Proportional pressure pilot valve code PVACRE***
- Pressure sensor SCP01-600-24-06 (for closed loop pressure control and horse power)
- Pressure compensator stage, code PVCM*U2** (with quick unload manifold: code PVCM*US**, with preload and quick unload manifold: code PVCM*UP**)
### 9. Trouble shooting guide

<table>
<thead>
<tr>
<th>Problem Description</th>
<th>Reason</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pump delivers no output flow</strong></td>
<td><strong>Drive motor does not turn</strong></td>
<td><strong>reason</strong> Motor is not connected correctly or one of the three phases has failed.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Check motor connections, check electrical power supply.</td>
<td><strong>solution</strong> Pump is mechanically blocked. Motor turns smoothly when disconnected from pump.</td>
</tr>
<tr>
<td><strong>Drive motor only turns at slow speed</strong></td>
<td><strong>reason</strong> Motor is not selected properly. Installed motor has not enough torque.</td>
<td><strong>solution</strong> Start pump at unloaded system. Use motor with more horse power.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Pump is hydraulically blocked. No function of compensator, no pressure relief valve;</td>
<td><strong>solution</strong> Check function of pump compensator (see below). Start pump at unloaded system.</td>
</tr>
<tr>
<td><strong>Drive motor turns, pump does not turn</strong></td>
<td><strong>reason</strong> Coupling is not or not correctly mounted.</td>
<td><strong>solution</strong> Check coupling assembly and correct it.</td>
</tr>
<tr>
<td><strong>Drive motor turns and pump turns</strong></td>
<td><strong>reason</strong> Wrong direction of rotation.</td>
<td><strong>solution</strong> Change direction of motor rotation.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Fluid reservoir empty or not filled to level, suction line ends above fluid level.</td>
<td><strong>solution</strong> Fill reservoir to required level, if necessary increase suction pipe length.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Suction line is blocked. E. g. by plugs, cleaning tissues, plastic-plugs.</td>
<td><strong>solution</strong> Check suction line for free flow. Open valves in suction line. Valves should be equipped with electrical indicator. Check suction filter.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Suction line not gas tight, pump gets air into suction port.</td>
<td><strong>solution</strong> Seal suction line against air ingress.</td>
</tr>
<tr>
<td><strong>Pump does not build up pressure, but delivers full flow at low pressure</strong></td>
<td><strong>reason</strong> Standard pressure compensator is set to minimum pressure.</td>
<td><strong>solution</strong> Adjust compensator setting to desired pressure.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Orifice in remote pressure compensator blocked.</td>
<td><strong>solution</strong> Make sure orifice Ø 0.8 mm in control spool is free and open.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> No pressure pilot valve connected to port P&lt;sub&gt;R&lt;/sub&gt;.</td>
<td><strong>solution</strong> Install suitable pressure pilot valve and adjust it to the desired setting.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Multiple pressure pilot selector valve is not energized; Pump works in stand-by.</td>
<td><strong>solution</strong> Energize selector valve solenoid.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> No load sensing line connected.</td>
<td><strong>solution</strong> Connect system load sensing port to compensator.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Load sensing valve is closed or too small.</td>
<td><strong>solution</strong> Open load sensing valve, use larger valve size.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Too much pressure drop between pump and load sensing valve.</td>
<td><strong>solution</strong> Make sure connection is wide enough and has not too much pressure drop.</td>
</tr>
<tr>
<td></td>
<td><strong>solution</strong> Differential pressure at compensator is adjusted properly (too low).</td>
<td><strong>solution</strong> Check differential pressure adjustment and correct it as described above.</td>
</tr>
</tbody>
</table>
### Trouble shooting guide

<table>
<thead>
<tr>
<th>Reason</th>
<th>Solution</th>
</tr>
</thead>
</table>
| **Pump does not build up pressure, but delivers full flow at low pressure** | Horse power compensator setting changed.  
*Check setting of horse power compensator and correct it, if required.*  
| Proportional displacement control is not connected as required.  
*Check wiring; connect according to installation manual for electronic module.*  
| Displacement transducer (LVDT) adjustment changed.  
*Correct zero setting at displacement transducer.*  
| Electronic module has no supply power.  
*Make sure module is powered with 22 - 36 V DC.*  
| Plug instead of orifice Ø 0,8 mm in the load sensing line to pump.  
*Install orifice as required.*  
| Cylinder block lifts from valve plate due to excessive wear.  
*Send pump to factory for service.*  
| **Pump does not compensate** | No orifice is in load sensing line to compensator code FFC.  
*Install orifice Ø 0,8 mm as shown in circuit diagram.*  
| No pressure pilot valve connected to compensator or valve is blocked.  
*Connect pressure pilot valve to compensator, make sure valve opens as required.*  
| Load sensing line connected incorrect (e. g. upstream of load sensing valve)  
*Connect load sensing line downstream (actuator side) of load sensing valve.*  
| No or too low pressure at pump outlet port.  
Pump outlet pressure must be at least 15 bar, because otherwise the bias spring in the pump cannot be compressed.  
| **Pump does not upstroke, sticks at zero displacement.** | Compensator is blocked due to contamination.  
*Clean hydraulic fluid, clean compensator valve.*  
| Cable to LVDT or proportional solenoid is interrupted  
*Check wiring and make sure cable is ok. Replace if necessary.*  
| **Compensator is unstable** | Compensor spool is sticking due to contamination of hydraulic fluid.  
*Clean hydraulic system, clean compensator valve.*  
| Compensator differential pressure changed (too low or too high)  
*Adjust compensator differential pressure to required setting.*  
| Wrong pilot orifice or pressure pilot valve improperly selected.  
*Select pilot orifice and pressure pilot valve as recommended.*  
| Dynamic critical system, e. g.: pressure compensator combined with pressure reducing valve, load sensing (flow) compensator combined with flow control valve.  
*use remote pressure compensator instead of standard pressure compensator, install orifice in load sensing line remote from compensator (as close as possible to load sensing valve).*  

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29 Parker Hannifin Manufacturing Germany GmbH & Co. KG  
Pump and Motor Division  
Chemnitz, Germany
Position notification regarding Machinery Directive 2006/42/EG:

Products made by the Pump and Motor Division (PMD) of Parker Hannifin are excluded from the scope of the machinery directive following the "Cetop" Position Paper on the implementation of the Machinery Directive 2006/42/EC in the Fluid Power Industry.

All PMD products are designed and manufactured considering the basic as well as the proven safety principles according to:

- SS EN ISO13849-2:2008-09, C.2 and C.3 and,
- SS EN 982+A1:2008,

so that the machines in which the products are incorporated meet the essential health and safety requirements.

Confirmations for components to be proven component, e.g. for validation of hydraulic systems, can only be provided after an analysis of the specific application, as the fact to be a proven component mainly depends on the specific application.

Dr. Hans Haas
General Manager Pump and Motor Division Europe
Chemnitz, Chomutov, Trollhättan, Kingswinford

---

**WARNING – USER RESPONSIBILITY**

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This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

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---

**Offer of Sale**

Please contact your Parker representation for a detailed "Offer of Sale".

---

Parker Hannifin Manufacturing Germany GmbH & Co. KG
Pump and Motor Division
Chemnitz, Germany