# PW/PWE 085 - 096

## HEAVY-DUTY HYDROSTATIC PUMP

TECHNICAL CATALOG

POCLAIN Hydraulics

HIGH PERFORMANCE

# OVERVIEW

PWe085/PWe096 is a compact unit able to be directy mounted on the main internal combustion engine, LPG or Diesel, or on a power take-off.

Variable displacement, axial piston pump, with swashplate system, for closed loop hydrostatic transmissions.

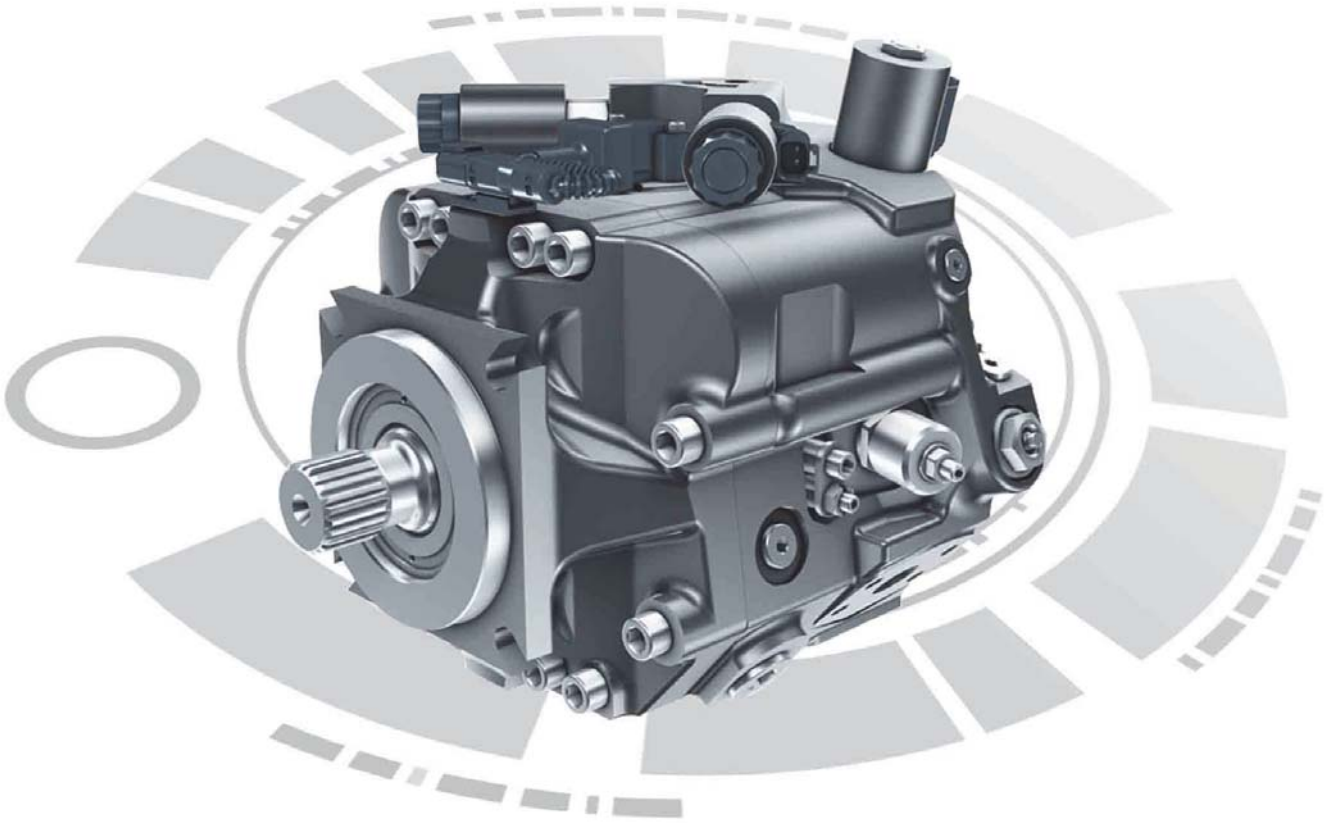
It provides a continuously variable flow rate between zero and maximum in forward and reverse direction. Flow rate is proportional to rotation speed and swashplate angle.

It is featured with a charge pump to keep the circuit pressurised. This avoids risk of cavitations and ensures a good performance of the transmission.

It is equipped with high pressure relief valves and control pressure cut-off valve.

It is available in single or tandem version.

As options PWe085/PWe096 can be featured with exchange valve, filter on charge pressure line and safety devices to ensure safe operation of the machine.



| | | PW/PWe085 | PW/PWe096 |
|---|---|---|---|
| **Displacement** | $cm^3$/rev *[$in^3$/rev.]* | 85,2 *[5.20]* | 96,4 *[5.88]* |
| **Max. peak pressure** | bar *[PSI]* | 500 *[7252]* | 450 *[6527]* |
| **Max. intermittent speed** | rpm | 3850 | 3850 |
| **Max. theoretical flow** | l/min *[GPM]* | 328 *[87]* | 371 *[98]* |
| **Mass** | kg *[lb]* | 71 *[157]* | |
| **Mounting flange** | | SAE - C | |
| **Control** | | Solenoid control with feedback sensor and control pressure cut-off valve | |

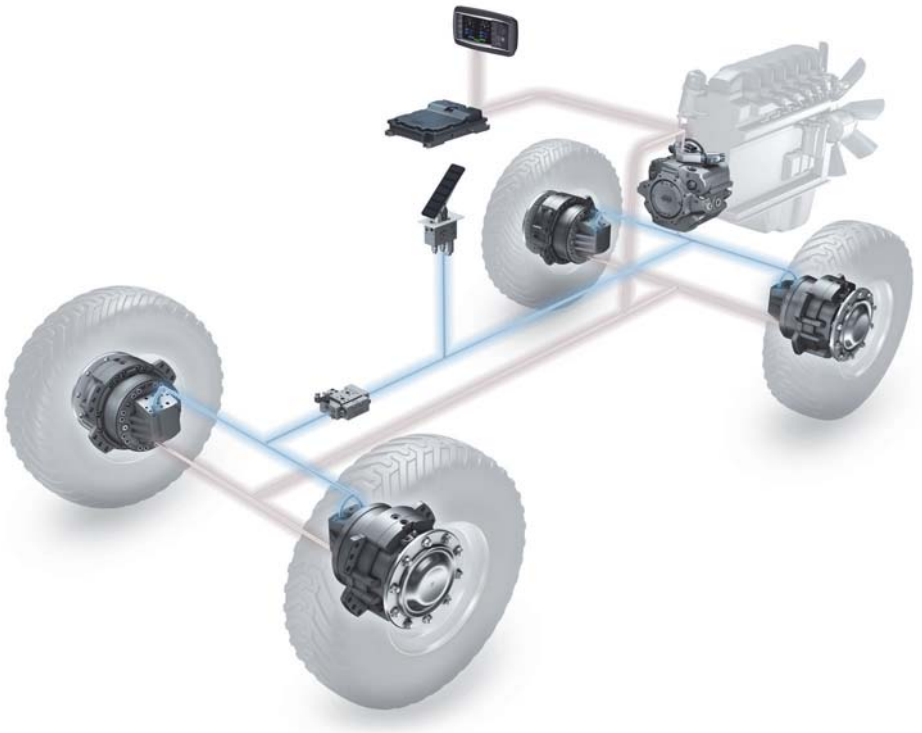
## The PW & PWe range: Productivity, Comfort and Energy Efficiency

Used in hydrostatic transmission systems composed of motors, valves, and electronic controls, the PW & PWe range offers you the benefit of over 50 years of expertise gained by Poclain Hydraulics in the field of hydrostatic transmissions.

The performance and added value they provide will help make your machines a commercial success.

The upcoming anti-pollution standards impose new constraints which must be taken into consideration. End users look for reliable, precise, high performance machines that minimize energy expenditure and maximize comfort.

Designed with compactness, energy efficiency and high power density in mind, the “Heavy Duty” PW & PWe pump range meets these requirements.







# CONTENT

# MODEL

Size D M C O H1 H2

P W e

**Embedded electronic** — **e**

Size

| **Displacement** cm³/rev *[in³/rev]* | |
|---|---|
| 85,2 *[5.20]* | **085** |
| 96,4 *[5.88]* | **096** |

D

| **Direction of rotation** | |
|---|---|
| Clockwise (CW) | **R** |
| Counterclockwise (CCW) | **L** |

M

| **Mounting flange and shaft** | |
|---|---|
| SAE-C; splined shaft; z = 21; 16/32 D.P. | **2** |
| SAE-C; splined shaft; z = 23; 16/32 D.P. | **3** |
| SAE-C; splined shaft; z = 13; 8/16 D.P. | **5** |
| SAE-C; splined shaft; z = 14; 12/24 D.P. * | **6** |

* Not recommended for front pump in tandem configuration.

C

| **Controls** | |
|---|---|
| Solenoid control 12 V with feedback sensor and control pressure cut-off valve | **A** |
| Solenoid control 24 V with feedback sensor and control pressure cut-off valve | **B** |

O

| **Ports** mm *[inch]* | | | | |
|---|---|---|---|---|
| (P) inlet | (S1) servo | (S2) servo | (T) | |
| w/o | w/o | w/o | N/A | **0** |
| 0,8 *[0.031]* | 0,8 *[0.031]* | 0,8 *[0.031]* | N/A | **1** |
| w/o | 1,5 *[0.059]* | 1,5 *[0.059]* | N/A | **2** |
| w/o | 0,8 *[0.031]* | 0,8 *[0.031]* | N/A | **3** |

H1

| **High pressure relief valve (A) **** bar (± 15) *[PSI (± 218)]* | |
|---|---|
| 320 *[4641]* | **A** |
| 350 *[5076]* | **B** |
| 380 *[5511]* | **C** |
| 400 *[5802]* | **D** |
| 420 *[6092]* | **E** |
| 450 *[6527]** | **F** |
| 480 *[6962]** | **G** |

* not available for PW096

H2

| **High pressure relief valve (B) **** bar (± 15) *[PSI (± 218)]* | |
|---|---|
| 320 *[4641]* | **A** |
| 350 *[5076]* | **B** |
| 380 *[5511]* | **C** |
| 400 *[5802]* | **D** |
| 420 *[6092]* | **E** |
| 450 *[6527]* * | **F** |
| 480 *[6962]* * | **G** |

* not available for PW096

# CODE

G L A F S P C E B

**G**

| **Charge pump displacement** cm³/rev *[in³/rev]* | |
|---|---|
| 17 *[1.04]** | **2** |
| 22 *[1.34]* | **3** |

*not available for PW096

**L**

| **Charge pressure relief valve **** bar (± 0,5) *[PSI (± 7.25)]* | |
|---|---|
| 18 *[261]* | **A** |
| 19 *[276]* | **B** |
| 20 *[290]* | **C** |
| 21 *[305]* | **D** |
| 22 *[319]* | **E** |
| 23 *[334]* | **F** |
| 24 *[348]* | **G** |
| 25 *[363]* | **H** |
| 26 *[377]* | **J** |
| 27 *[392]* | **K** |
| 28 *[406]* | **L** |
| 29 *[421]* | **M** |
| 30 *[435]* | **N** |

**A**

| **Auxiliary mounting pad** | |
|---|---|
| Without auxiliary mounting pad | **0** |
| SAE-A; z = 9; 16/32 D.P. | **1** |
| SAE-B; z = 13; 16/32 D.P. | **2** |
| SAE-BB; z = 15; 16/32 D.P. | **3** |
| SAE-C; z = 14; 12/24 D.P. | **4** |
| SAE-C; z = 21; 16/32 D.P. | **5** |

**F**

| **Filtration** | |
|---|---|
| Suction filtration (no filter) | **0** |
| Integral filter (filtration after charge pump) + filtration bypass | **A** |
| Integral filter (filtration after charge pump) + pollution indicator + filtration bypass | **B** |
| Remote filtration | **C** |

**P** (Only available for PWe)

| **Software packages** | |
|---|---|
| Standard packages | **A** |
| Standard + Driving packages | **B** |
| Standard + Protection packages | **C** |
| Standard + Driving + Protection packages | **D** |
| CAN slave | **E** |

**C** (Only available for PWe)

| **Pump command interface** | |
|---|---|
| Joystick (Electronic) | **A** |
| Travel pedal (Electronic) | **B** |
| DA-Like automotive | **C** |
| No pump command interface | **0** |

**E** (Only available for PWe)

| **Engine management** | |
|---|---|
| No engine management | **0** |
| CAN engine management | **A** |

**B** (Only available for PWe)

| **Brake/Inching pedal** | |
|---|---|
| No braking/inching management | **0** |
| Braking/inching management | **A** |

**S**

| **Options** | |
|---|---|
| Without option | **0** |
| T4 speed sensor (without rotation direction) | **2** |
| Predisposition for speed sensor | **8** |
| Bypass of orifices in SA control (only on PW) | **B** |
| Without control pressure cut-off valve (only on PW) | **C** |
| Special paint or no paint | **D** |
| Exchange valve | **H** |
| 2 bolt bearing flange mounting | **M** |
| Customized identification plate | **P** |
| Pressure sensors on A&B lines | **R** |
| Temperature sensor | **T** |

**In case of request for a combination of several options, please contact your Poclain Hydraulics application engineer for further information.**

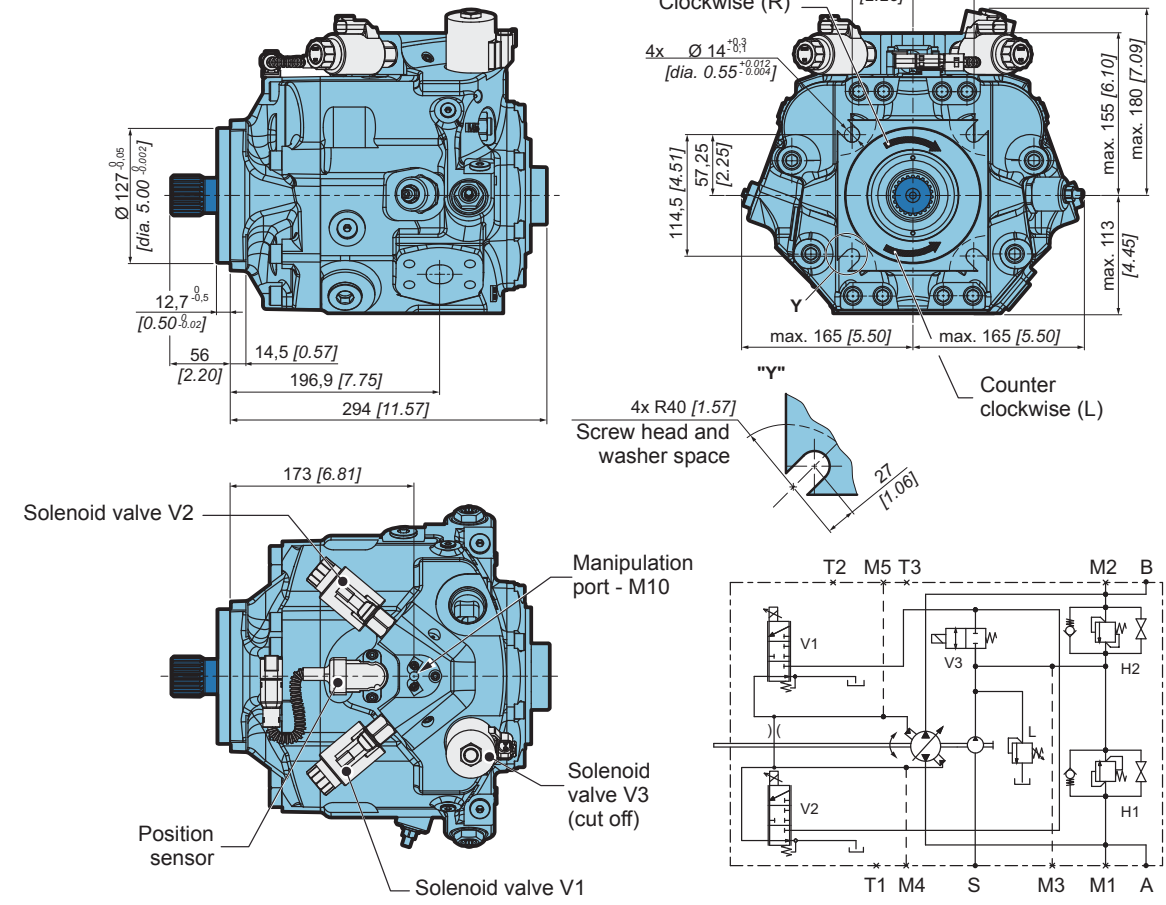
**

**Consult setings of HPRVs and CPRV with your Poclain Hydraulics application engineer in order to avoid that maximum pressure is exceeded.**

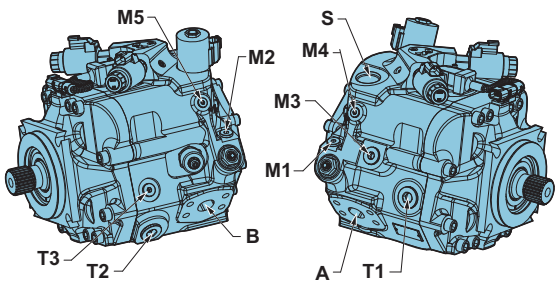
# TECHNICAL SPECIFICATIONS

## Main dimensions for PW

| | | D | M | C | O | H1 | H2 | G | L | A | F | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P W | 0 8 5<br>0 9 6 | | | | | | | | | | | |



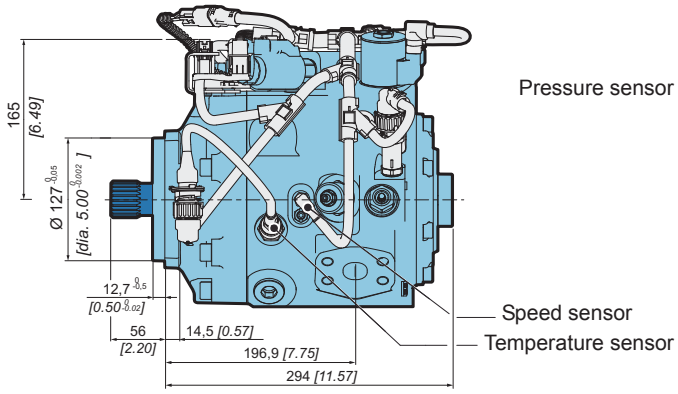

## Port characteristics

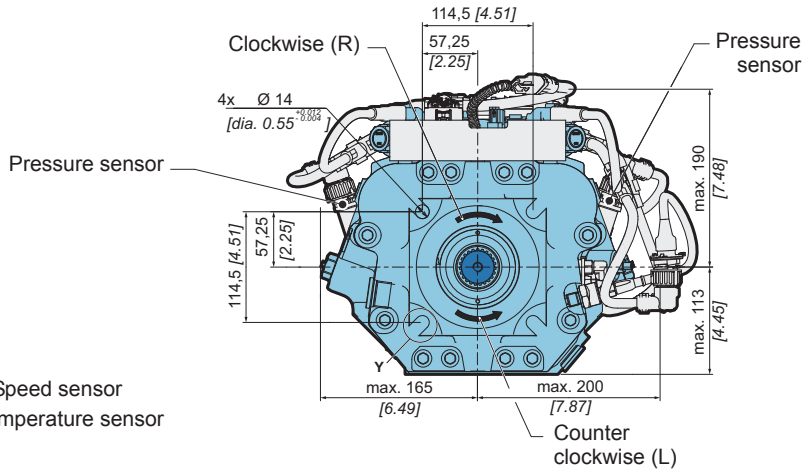


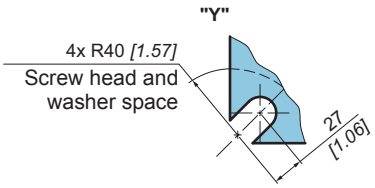

| Port | Function | Size | Norm |
|---|---|---|---|
| A, B | Main port | PN400 DN25<br>4xM12 | ISO 6162-2 |
| S | Charge inlet | 1 5/16-12 UN-2B | ISO 11926-1 |
| M1/M2 | A-B ports pressure gauge | 13G - G1/4 | ISO 1179-1 |
| M3 | Charge pressure | 7/8-14 UNF-2B | ISO 11926-1 |
| M4/M5 | Gauge control pressure | 7/16-20 UNF-2B | ISO 11926-1 |
| T1/T2 | Gauge case drain | 1 1/6-12-UN-2B | ISO 11926-1 |
| T3 | Drain temperature port | 13G - G1/4 | ISO 1179-1 |

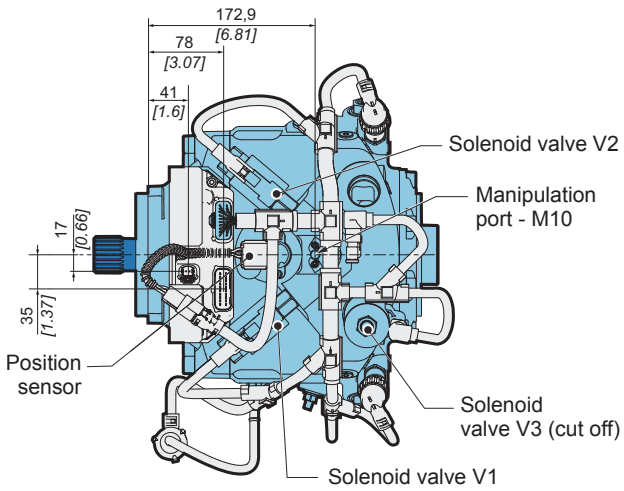
## Main dimensions for PWe

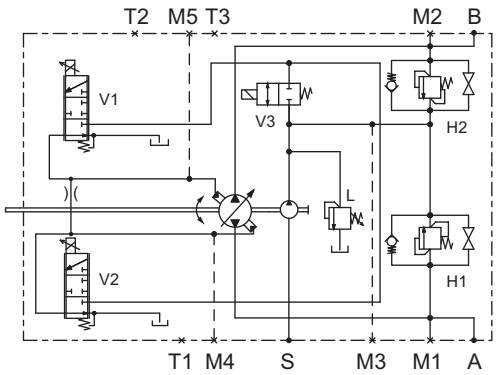
| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P W e | 0 8 5 / 0 9 6 | D | M | C | O | H1 | H2 | G | L | A | F | S | | | | | P | C | E | B |



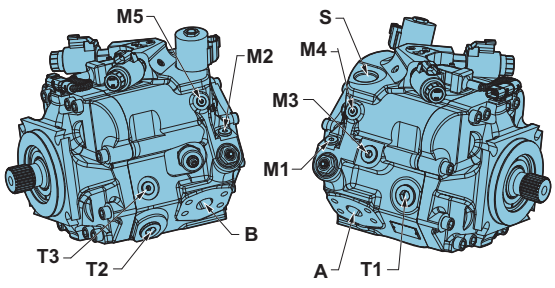




## Port characteristics




| Port | Function | Size | Norm |
|---|---|---|---|
| A, B | Main port | PN400 DN25 4xM12 | ISO 6162-2 |
| S | Charge inlet | 1 5/16-12 UN-2B | ISO 11926-1 |
| M1/M2 | A-B ports pressure gauge | 13G - G1/4 | ISO 1179-1 |
| M3 | Charge pressure | 7/8-14 UNF-2B | ISO 11926-1 |
| M4/M5 | Gauge control pressure | 7/16-20 UNF-2B | ISO 11926-1 |
| T1/T2 | Gauge case drain | 1 1/6-12-UN-2B | ISO 11926-1 |
| T3 | Drain temperature port | 13G - G1/4 | ISO 1179-1 |

# OPERATING PARAMETERS

## Operating parameters

| | | | PW/PWe085 | PW/PWe096 |
|---|---|---|---|---|
| **Speed ratings** | Minimum | min$^{-1}$(rpm) | 500 | |
| | Nominal | | 2000 | |
| | Max. continuous | | 3650 | |
| | Max. intermittent | | 3850 | |
| Maximum pressure (port A or B) | | bar *[PSI]* | 450 *[6527]* | 400 *[5802]* |
| Maximum peak pressure (port A or B) | | | 500 *[7252]* | 450 *[6527]* |
| Charge pressure (port M3) | | | 30 *[435]* | |
| Minimum pressure at charge inlet (port S) | | | 0,7 *[10.2]* | |
| Continuous case drain (port T1 or T2) | | | 3 *[43.5]* | |
| Intermittent case drain (port T1 or T2) | | | 5 *[72.5]* | |
| Pressure in piloting chamber (port M4 or M5) | | | 30 *[435]* | |
| Mass moment of inertia of rotating components | | kg.m$^2$ *[slug.ft$^2$]* | 0,0127 *[0.0091]* | 0,0125 *[0.0089]* |
| Pump torque at $v_{g\ max}$ and $\Delta p$ | | Nm *[in.lbf]* $\Delta p$ = bar *[PSI]* | 582 *[5151]* $\Delta p$ = 430 *[6237]* | 580 *[5133]* $\Delta p$ = 380 *[5511]* |
| Theoretical Power | | kW *[hp]* | 223 *[299]* | |
| at $v_{g\ max}$, max. continuous speed and $\Delta p$ | | $\Delta p$ = bar *[PSI]* | $\Delta p$ = 430 *[6237]* | $\Delta p$ = 380 *[5511]* |

## Charge pressure

A charge flow is required to maintain a positive pressure in the low pressure loop of a closed loop hydrostatic transmission. Charge pressure ensures proper lubrication and rotating group operation. It is recommended to maintain the charge pressure at a minimum of 6 bar *[87 PSI]* above case pressure. For more details, refer to charge pump paragraph, page 21.

## Case pressure

Case pressure must be maintained within the limits shown in the table "Operating parameters". Ensure that housing is always filled with hydraulic fluid and especially during start-up of the machine.

## Pressure ratings

**Maximum peak pressure**
It is the maximum allowable pressure. A self-propelled machine can reach the maximum peak pressure value no more than 1-2% of that work cycle.

**Work cycle**
A fundamental factor for ensuring correct hydrostatic transmission sizing is the machine work cycle (pressure-time ratio, seasonality, pressure vs. percentage of time at max. displacement, machine type). Part service life depends on the correct choice in relation to the work cycle.

**Overloads**
It is mandatory to protect parts against any possible overloads.

## Speed ratings

The table "Operating parameters" gives minimum and maximum rated speeds.

**Maximum speed** is the highest operating speed allowed. Over speeding reduces pump life time, can lead to loss of hydrostatic power and braking capacity. Never exceed the maximum speed limit under any operating conditions.

**Nominal speed** is the speed offering the maximal efficiency.

## Poclain Hydraulics recommandations for fluid

Poclain hydraulics recommends the use of hydraulic fluids defined by the ISO 15380 and ISO 6743-4 standards.
For temperate climates, the following types are recommended.
- HM 46 or HM 68 for fixed installations.
- HV 46 or HV 68 for mobile installations.
- HEES 46 for mobile installations.

These specifications correspond to category 91H of the CETOP standard, parts 1, 2 and 3 of the DIN 51524 standard, and grades VG32, VG 46 and VG68 of the ISO 6743-4 standards.

It is also possible to use ATF, HD, HFB, HFC or HFD type hydraulic fluid upon Poclain Hydraulics specific approval of the components' operating conditions.

Standardized designations for the fluids
- **HM :** Mineral fluids having specific antioxidant, anticorrosion and antiwear properties (HLP equivalent to DIN 51524 parts 1 and 2).
- **HV :** HM mineral fluids providing improved temperature and viscosity properties (DIN 51524 part 3).
- **HEES :** Biodegradable fluids based on organic esters.

**It is also possible to use a fluid that meets the biodegradability criteria and is compatible in the event of accidental food contact. The BIOHYDRAN FG 46 fluid designed by the company Total has undergone testing of its properties and performance on our test benches. Since this type of fluid has not yet been categorized, it is the responsibility of machine manufacturers to validate its compatibility with all of the components used in order to guarantee that the intended functions will be fulfilled and this for the desired life time of all equipment items.**

**For biodegradable fluids, consult your Poclain Hydraulics' application engineer.**

**During operation, the temperature of the oil must be between 0°C *[32°F]* and 80°C *[176°F]*; the minimum and maximum temperatures may be exceeded momentarily by ± 20°C *[± 68°F]* for a duration of less than 30 minutes. For all applications outside these limits, please consult with your Poclain Hydraulics' application engineer.**



## Fluid and filtration

To prevent premature wear, it is imperative that only clean fluid enter the hydrostatic transmission circuit. A filter capable of controlling the fluid cleanliness to ISO 4406 class 22/18/13 (SAE J1165) or better under normal operating conditions is recommended.

The filter may be located either on the inlet (suction filtration) or discharge (charge pressure filtration) side of the charge pump. The selection of a filter depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity.

Filter efficiency may be measured with a Beta ratio[1] ($\beta_X$). For simple suction-filtered closed circuit transmissions and open circuit transmissions with return line filtration, a filter with a $\beta$-ratio within the range of $\beta_{35\text{-}45} = 75$ ($\beta_{10} \geq 2$) or better has been found to be satisfactory. For some open circuit systems, and closed circuits with cylinders being supplied from the same reservoir, a considerably higher filter efficiency is recommended. This also applies to systems with gears or clutches using a common reservoir. For these systems, a charge pressure or return filtration system with a filter $\beta$-ratio in the range of $\beta_{15\text{-}20} = 75$ ($\beta_{10} \geq 10$) or better is typically required.

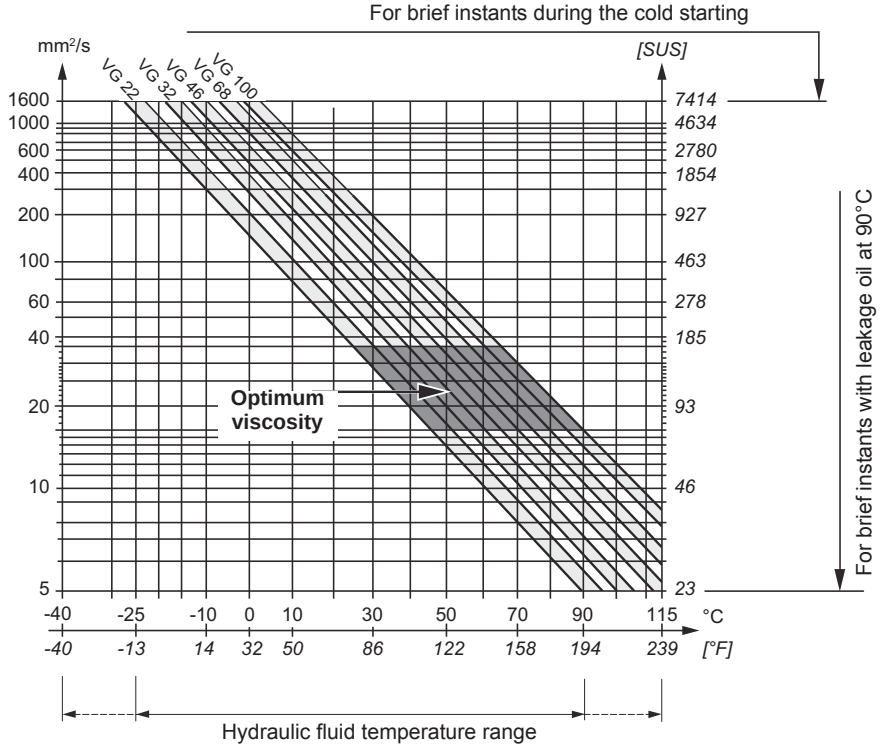
Because each system is unique, only a thorough testing and evaluation program can fully validate the filtration system.

*[1] Filter $\beta_x$-ratio is a measure of filter efficiency defined by ISO 4572. It is defined as the ratio of the number of particles greater than a given diameter ("x" in microns) upstream of the filter to the number of these particles.*

## Viscosity range

For both max. efficiency and life of the unit, the operative viscosity should be chosen within the optimum range of:
√opt = optimum operating viscosity from 16 to 36 $mm^2/s$ *[from 74.1 to 166.8 SUS]* referred to the closed loop temperature.

**Working conditions:** the following limits of viscosity apply
√min = 5 $mm^2/s$ *[23 SUS]* short-duration at a max. permissible leakage oil temperature of 90° C *[194°F]*
√max = 1000 $mm^2/s$ *[4 634 SUS]* short-duration, on cold start.




**Ensure fluid temperature and viscosity limits are concurrently satisfied.**

# SYSTEM DESIGN PARAMETERS

**Consult your Poclain Hydraulics application engineer to validate your design parameters before using the pump in your application.**

## Sizing equations

The following equations are helpful when sizing hydraulic pumps. Generally, the sizing process is initiated by an evaluation of the machine system to determine the required motor speed and torque to perform the necessary work function. First, the motor is sized to transmit the maximum required torque. The pump is then selected as a flow source to achieve the maximum motor speed.

| | | | | | | |
|---|---|---|---|---|---|---|
| SI units | **Output flow Q** | = | $\frac{V_g.n.\eta_v}{1000}$ | | | (l/min) |
| | **Input torque M** | = | $\frac{V_g.\Delta_p}{20.\pi.\eta_m}$ | | | (N.m) |
| | **Input power P** | = | $\frac{M.\ n.\pi}{30\ 000}$ | = | $\frac{Q.\Delta_p}{600.\eta_t}$ | (kW) |
| US units | **Output flow Q** | = | $\frac{V_g.n.\eta_v}{231}$ | | | *[GPM]* |
| | **Input torque M** | = | $\frac{V_g.\Delta_p}{2.\pi.\eta_m}$ | | | *[lbf.in]* |
| | **Input power P** | = | $\frac{M.n.\pi}{198\ 000}$ | = | $\frac{Q.\Delta_p}{1714.\eta_t}$ | *[hp]* |

$V_g$=Displacement per revolution $cm^3/tr$ *[$in^3/rev$]*
$\Delta p = p_o - p_i$ (system pressure) bar *[PSI]*
n = Speed $min^{-1}$ *[rpm]*
$\eta_v$ = Volumetric efficiency
$\eta_m$ = Mechanical efficiency
$\eta_t$ = Overall efficiency ($\eta v.\eta m$)

## Redundant braking system requirement

**Unintended vehicle or machine movement hazard.**
**The loss of hydrostatic drive line power, in any mode of operation (forward, neutral, or reverse) may cause the system to lose hydrostatic braking capacity. You must provide a braking system, redundant to the hydrostatic transmission, sufficient to stop and hold the vehicle or machine in the event of hydrostatic drive power loss.**

## Reservoir

The reservoir provides clean fluid, dissipates heat, and removes entrained air from the hydraulic fluid. It allows for fluid volume changes associated with fluid expansion and cylinder differential volumes. Minimum reservoir capacity depends on the volume needed to perform these functions. Typically, a capacity of one half of the charge pump flow (per minute) is satisfactory for a closed reservoir. Open circuit systems sharing a common reservoir require greater fluid capacity.

Locate the reservoir outlet (suction line) near the bottom, allowing clearance for settling foreign particles. Use a 100 - 125 µm screen covering the outlet port.

Place the reservoir inlet (return lines) below the lowest expected fluid level, as far away from the outlet as possible.

Use a baffle (or baffles) between the reservoir inlet and outlet ports to promote de-aeration and reduce fluid surging.

## Case drain usage for tandem pump

A case drain line must be connected to one of the case outlets (T1 or T2) to return internal leakage to the system reservoir. The higher of the two case outlets should be used to promote complete filling of the case. Since the case drain fluid is typically the hottest fluid in the system, it is advantageous to return this flow through heat exchanger.

## Bearing life and external shaft loading

**Bearing life**:

Bearing life is a function of speed, pressure , swashplate angle and external loads. Oil type and viscosity impact bearing life.

| | Bearing life ($B_{10}$ hours) | |
|---|---|---|
| | Standard 4-bolt flange | 2-bolt flange (option M) |
| **PW/PWe085** | 34 000 | 26 500 |
| **PW/PWe096** | 23 000 | 17 700 |

Normal bearing life in $B_{10}$ hours is shown in the above table. Figures have been calculated under the following operating conditions: Continuous differential pressure of 320 bar *[4 641 PSI]*, 2000 rpm shaft speed, maximum displacement, without any external shaft side load. The data is based on a 50% forward, 50% reverse duty cycle, standard charge pump size, and standard charge pressure.

**Shaft Loads:**

PW/PWe 085-096 pumps are designed with bearings that can accept external radial and thrust loads. The external radial shaft load limits depend on the load position, orientation, and operating conditions of the unit.

**The maximum permissible radial load (Re)**, is based on the **maximum external moment (Me)**, and the **distance (L)** from the mounting flange to the load. It may be determined using the table and formula below. Thrust (axial) load limits are also shown.

**Re = Me / L**

All external shaft loads affect bearing life. In applications with external shaft loads, minimize the impact by positioning the load at 0° or 180° as shown in the figure.

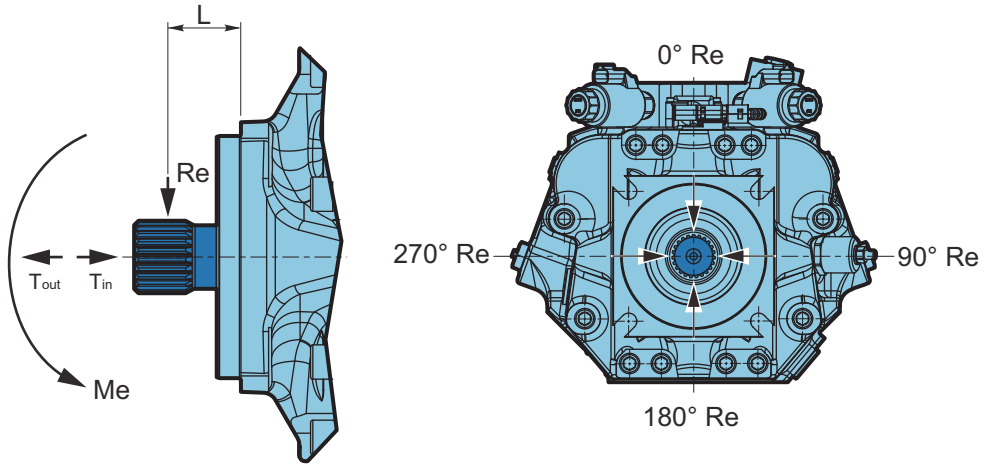
Contact your Poclain Hydraulics representative for an evaluation of unit bearing life if:

- Continuously applied external loads exceed 25 % of the maximum allowable radial load Re.
- The pump swashplate is positioned on one side of center all or most of the time.
- The unit bearing life ($B_{10}$) is critical.

**Radial load position**

| | External moment (Me) N.m *[in.lbf]* | Maximum shaft thrust in ($T_{in}$) N *[lbf]* | Maximum shaft thrust out ($T_{out}$) N *[lbf]* |
|---|---|---|---|
| **PW/PWe085 PW/PWe096** | 120 *[1062]* | 4000 *[899]* | 2400 *[540]* |

at 200 bar *[2901 PSI]* and 2000 rpm




**For an accurate calculation, consult your Poclain Hydraulics application engineer.**



## Hydraulic unit life

Hydraulic unit life is the life expectancy of the hydraulic components. It depends on speed and system pressure.High pressure, generated by high load, reduces hydraulic unit life.

Design the hydraulic system according to the expected machine duty cycle. Take in consideration the expected percentages of time at various loads and speeds. Ask your Poclain Hydraulics representative to calculate an appropriate pressure based your hydraulic system design. If duty cycle data is not available, input power and pump displacement are used to calculate system pressure.

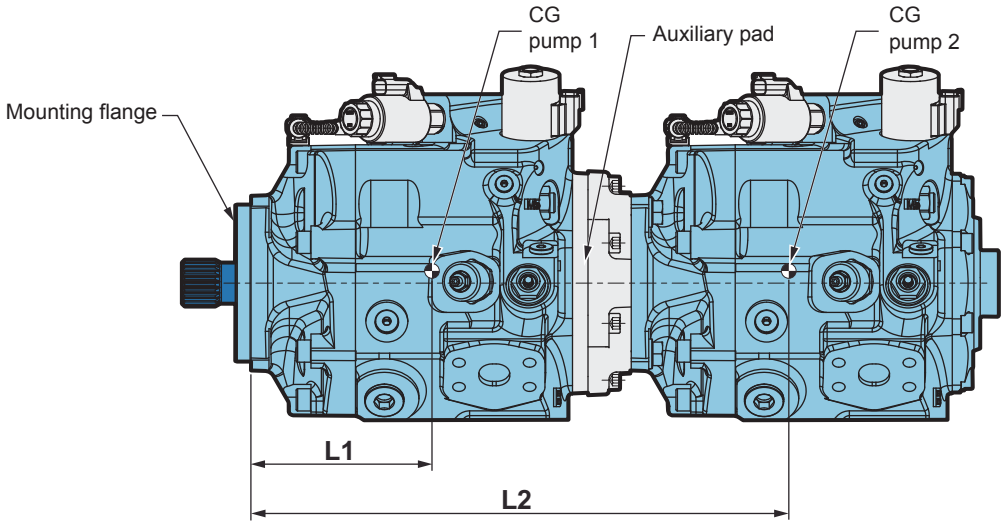
All pressure limits are absolute pressures.

PWe085 / PWe096 pumps will meet satisfactory life expectancy if applied within the parameters specified in this technical documentation. For more detailed information see Operating Parameters on 11.

## Mounting flange loads

Adding tandem mounted pumps, and/or tandem auxillary pump(s), subjecting pumps to shock loads may generate excessive loads on the front mounting flange. The overhung load moment for multiple pump mounting can be estimated as shown in the figure bellow

**Overhung load example**




**Estimating overhung load moments**

W = Weight of pump (kg)
L = Distance from mounting flange to pump center of gravity (CG)

$M_R = G_R (W_1L_1 + W_2L_2 + ... + W_nL_n)$

$M_S = G_S (W_1L_1 + W_2L_2 + ... + W_nL_n)$

Where:

$M_R$ = Rated load moment (N.m)
$M_S$ = Shock load moment (N.m)
$G_R$*= Rated (vibratory) acceleration (m/sec²) = 10*g
$G_S$*= Maximum shock acceleration (m/sec²) = 20*g

*Calculations is carried out by multiplying the gravity (g = 9.81 m/sec²) with a given factor.

Allowable overhung load moment are shown in the table below**.** Exceeding these values requires additional pump support.

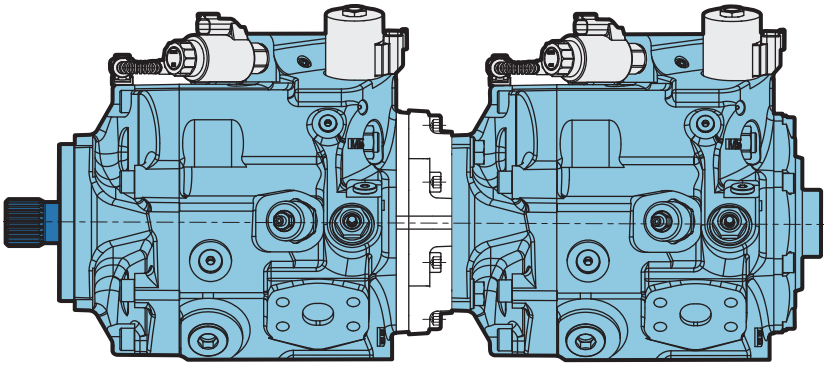
| | **Rated moment ($M_R$)** N.m *[in.lbf]* | **Shock load moment ($M_S$)** N.m *[in.lbf]* |
|---|---|---|
| **4-bolt mounting flange** | 4200 *[37 173]* | 8400 *[74 346]* |
| **2-bolt mounting flange (option M)** | 1400 *[12 391]* | 4000 *[35 403]* |

**For an accurate calculation, consult your Poclain Hydraulics application engineer.**

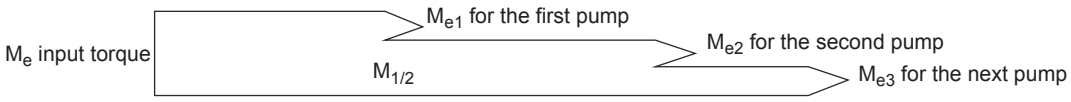
## Tandem pumps

For tandem definition ensure that:

- maximum shaft and coupling torques will not be exceeded, see section “Mounting flange and shafts”, page 25 and “Auxiliary mounting pad”, pages 26 to 28.
- maximum overhung load moment will not be exceeded otherwise use of additional pump support will be needed, see the page 17 for allowable moment values.



**Front axial pump** **Rear axial pump**




**Contact your Poclain Hydraulics application engineer for specific tandem configurations.**

# FEATURES

## High pressure relief valve

The high pressure relief valves maintain circuit pressure in the proper range. The check valves allow charge flow to replenish the low pressure loop of the circuit. The high pressure relief valves ensure a high pressure protection of the high pressure loop of the circuit.

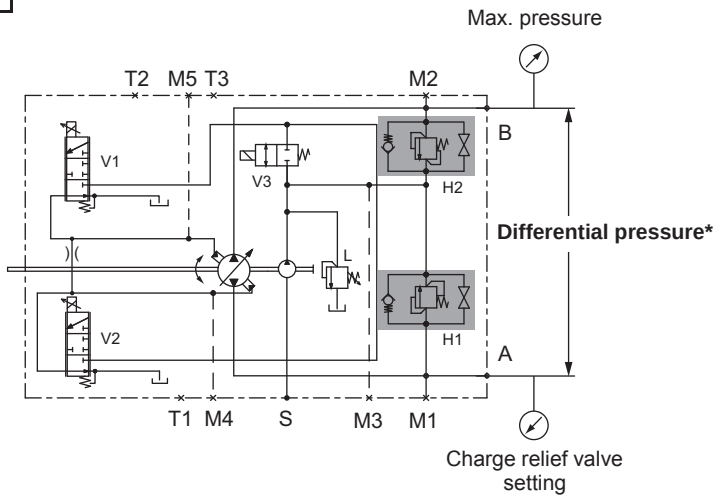
High pressure relief valves are available in a range of settings with tolerance ± 15 bar *[218 PSI]*.

Bypass of A and B ports is integrated in high pressure relief valves. The bypass connect the ports A-B and must be used only in emergency case and only for short movement.

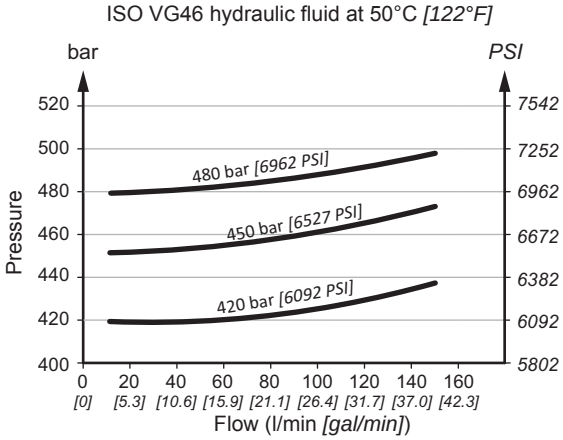
**High pressure relief valves are intended for transient overpressure protection and are not intended for continuous pressure control. Flow over relief valves for extended periods of time may result in severe heat build up. High flows over relief valves may result in pressure levels exceeding the nominal valve setting and potential damage to system components.**

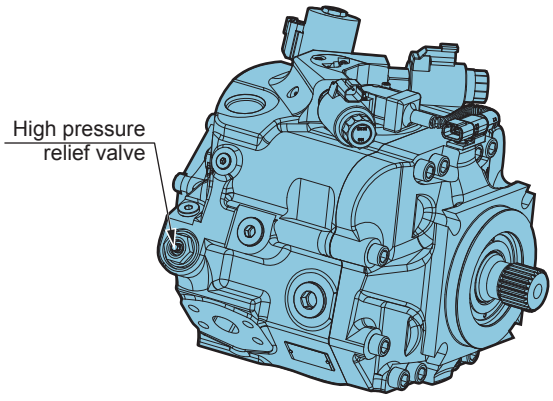
| PW085 / PWe096 | D | M | C | O | H1 | H2 | G | L | A | F | S | P | C | E | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |

| High pressure relief valve available setting bar *[PSI]* PW/PWe 085-096 | | H1 | H2 |
|---|---|---|---|
| 320 *[4 641]* | | A | A |
| 350 *[5 076]* | | B | B |
| 380 *[5 511]* | | C | C |
| 400 *[5 802]* | | D | D |
| 420 *[6 092]* | | E | E |
| 450 *[6 527]* | - | F | F |
| 480 *[6 962]* | - | G | G |




*** Differential pressure = High pressure relief valve setting (Max. pressure = HPRV setting + CPRV setting)**




**Max flow through relief function is 150l/min.**

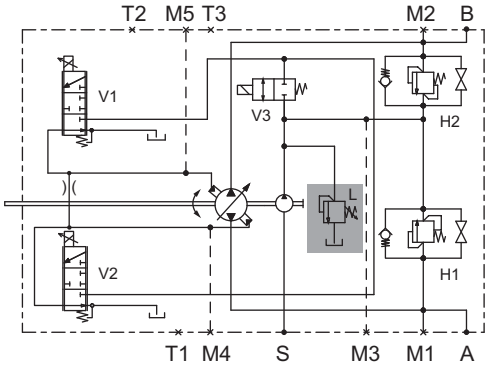
## Charge pressure relief valve

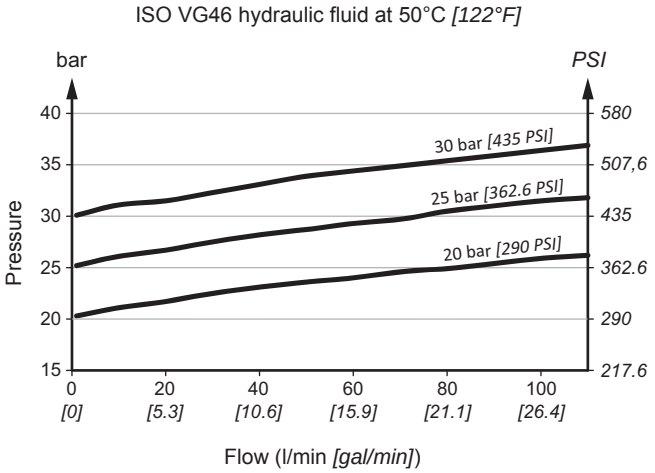
The charge pressure relief valve provides a relief outlet for charge circuit. This valve is used to set the charge pressure of the circuit. Flow through the valve is ported to case.

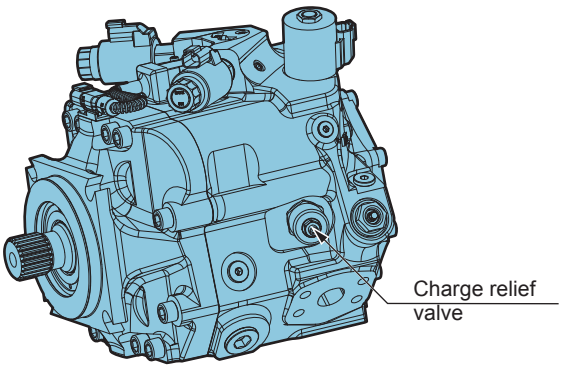
The nominal charge relief setting is referenced to case pressure.

**Incorrect charge pressure settings may result in the inability to build required system pressure and/or inadequate loop flushing flows. Ensure correct charge pressure under all conditions of operation to maintain pump control performance.**


| Charge relief valve available settings bar *[PSI]* | |
|---|---|
| 18 *[261]* | A |
| 19 *[276]* | B |
| 20 *[290]* | C |
| 21 *[305]* | D |
| 22 *[319]* | E |
| 23 *[334]* | F |
| 24 *[348]* | G |
| 25 *[363]* | H |
| 26 *[377]* | J |
| 27 *[392]* | K |
| 28 *[406]* | L |
| 29 *[421]* | M |
| 30 *[435]* | N |

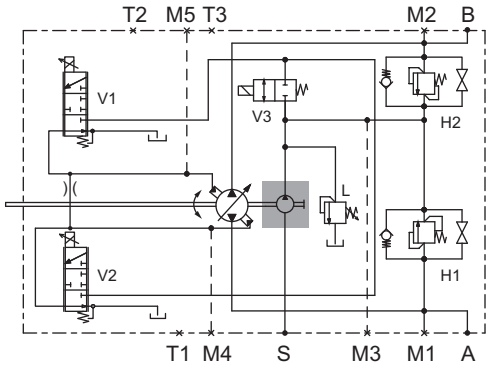


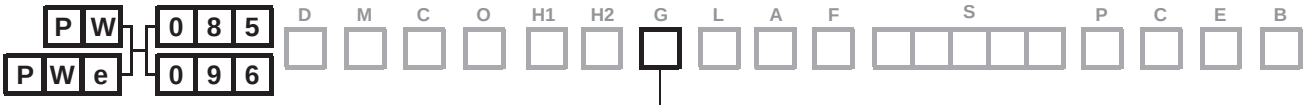
## Charge pump

Charge flow is required on all PW/PWe 085-096 pumps used in closed circuit installations. The charge pump provides flow to make up internal leakage, maintain a positive pressure in the main circuit, provide flow for cooling and filtration, replace any leakage losses from external valving or auxiliary systems, and to provide flow and pressure for the control system.
Many factors influence the charge flow requirements. These factors include system pressure, pump speed, pump swashplate angle, type of fluid, temperature, size of heat exchanger, length and size of hydraulic lines, control response characteristics, auxiliary flow requirements, hydrostatic motor type, etc.
Unusual application conditions may require a more detailed review of charge pump sizing. Charge pressure must be maintained at a specified level under all operating conditions to prevent damage to the transmission. Poclain Hydraulics recommends testing under actual operating conditions to verify this.




**Charge pump sizing/selection**

In most applications a general guideline is that the charge pump displacement should be at least 20% of the main pump displacement.

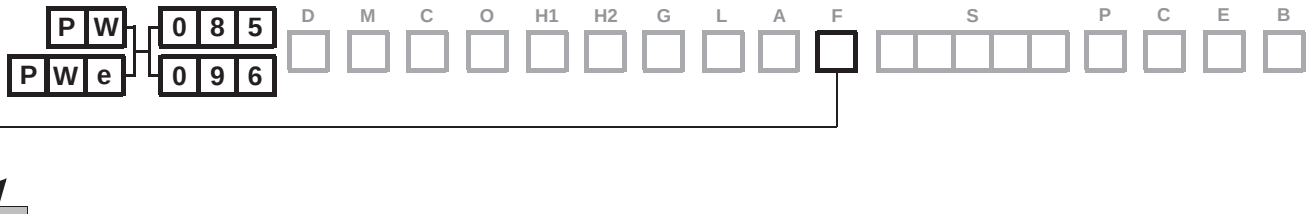



| Charge pump | Displacement cm³/rev *[in³/rev]* | |
|---|---|---|
| Optional* | 17 *[1.04]* | **2** |
| Standard | 22 *[1.34]* | **3** |

* not available for PW096

**Contact your Poclain Hydraulics application engineer for more information.**

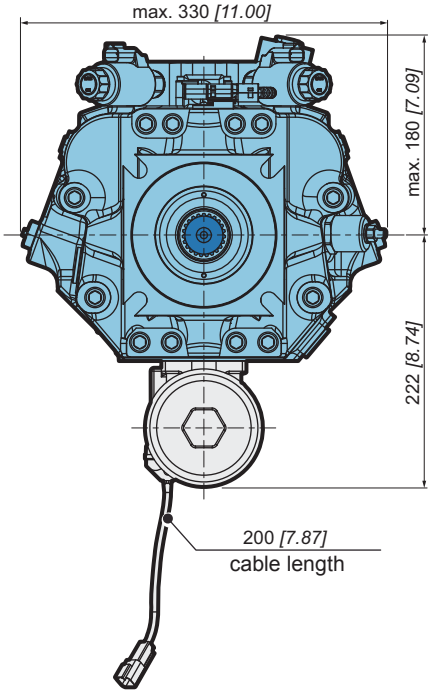
## Filtration

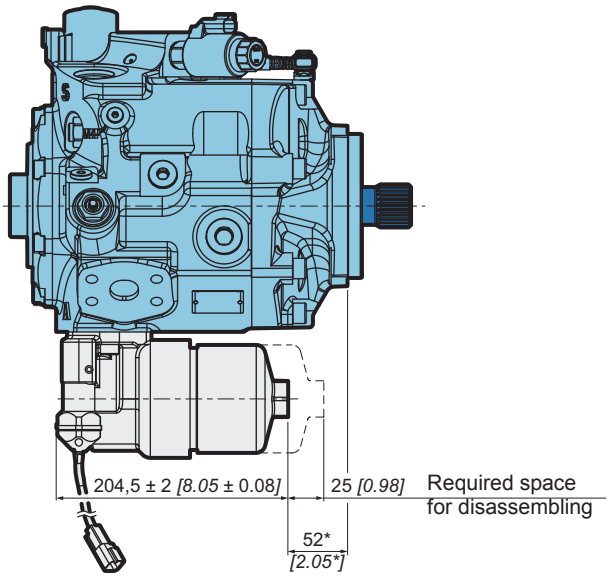



**0** **Suction filtration**

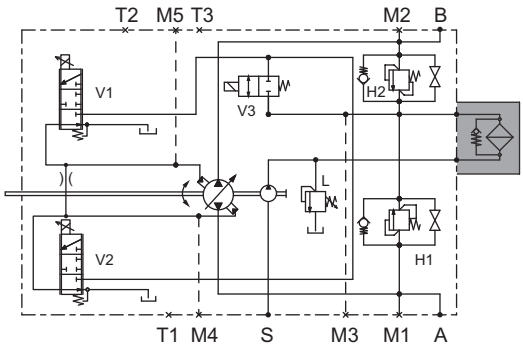
The suction filter is placed in the circuit between the reservoir and the inlet to the charge pump. The use of a filter contamination monitor is recommended.

**A** **Integral filter**



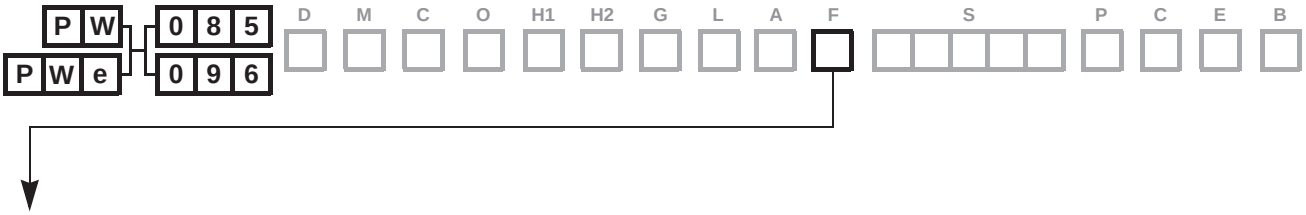




* 38 [1.50] for 2-bolt bearing flange (option M)



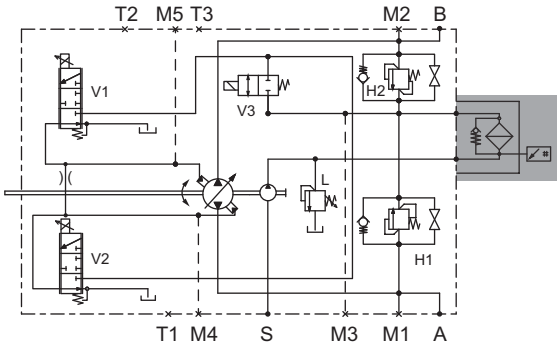

| Filter characteristic | |
|---|---|
| Max. operating pressure | 40 bar [580 PSI] |
| Operating temperature | -30°C~ 100°C [-22°F ~ 212°F] |
| Connector | Deutsch DT04-2P |
| Protection | IP67 |

## Filtration



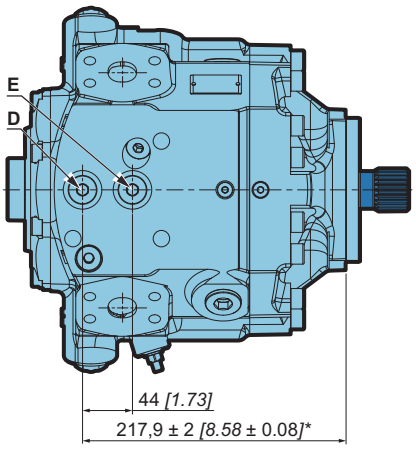

**B** **Integral filter with pollution indicator**

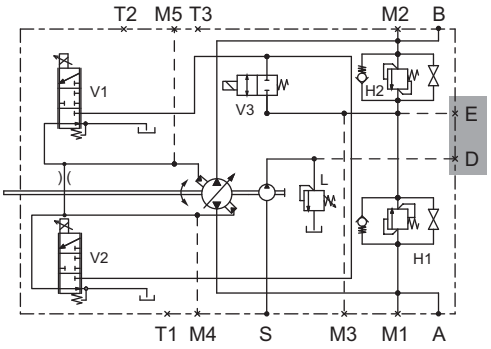
Integral filter can be equipped with pollution indicator for early warning that the filter needs to be cleaned or replaced.




**C** **Remote pressure filtration**

The pressure filter can be mounted remotely for easy servicing. A 100-125 µm mesh screen, located in the reservoir or the charge inlet line, is recommended when using charge pressure filtration. The remote pressure filter has to be capable to withstand charge pressure.



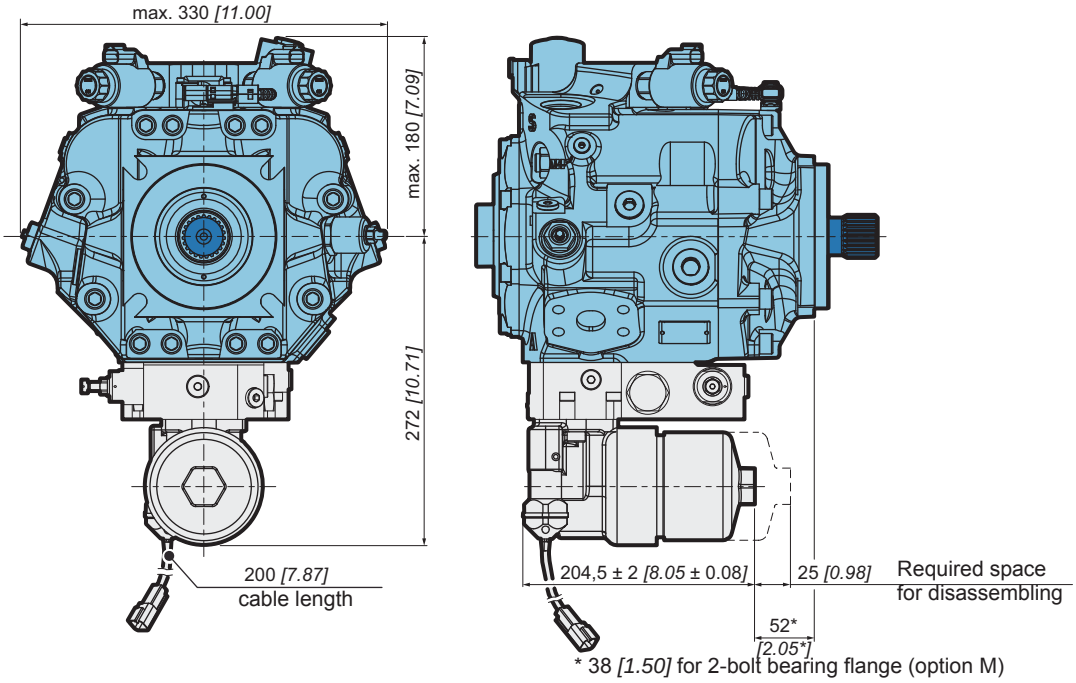



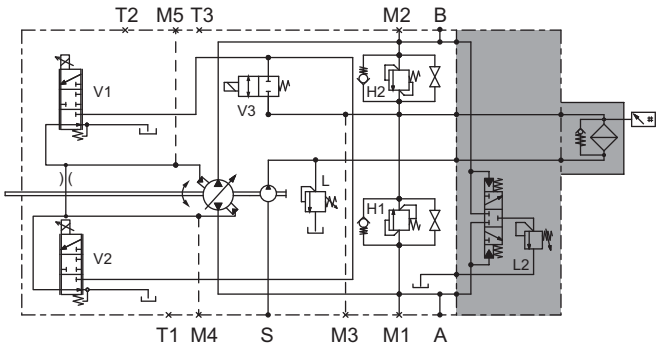

* 203,9 ±2 *[8.03 ± 0.08]* for 2-bolt bearing flange (option M)

| Port | Function | Size | Norm |
|---|---|---|---|
| D | Charge filtration port - filter input | 7/8-14 UNF-2B | ISO 11926-1 |
| E | Charge filtration port - filter output | | |

## Filtration


| | |
|---|---|
| **A** | **Integral filter with exchange valve** |
| **B** | **Integral filter with pollution indicator and with exchange valve** |



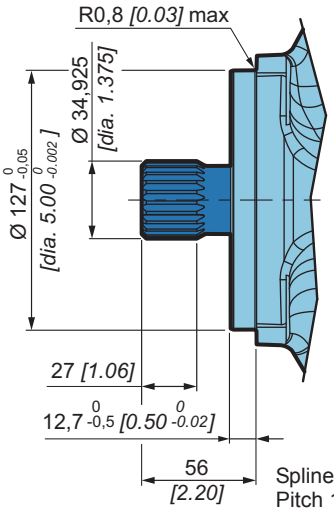



## Mounting flange and shafts

**SAE-C; splined shaft**

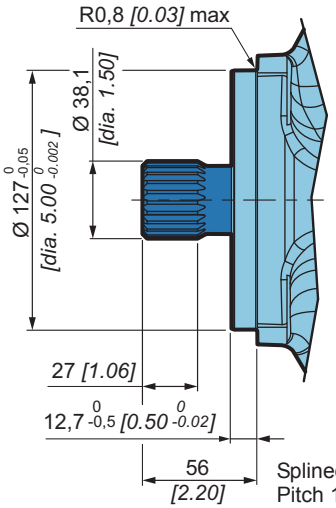
| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PW / PWe | 085 / 096 | D | M | C | O | H1 | H2 | G | L | A | F | S | | | | | P | C | E | B |

### 2 — 21 teeth; Shaft torque: 820 Nm *[7 258 in.lbf]*
(without radial force)



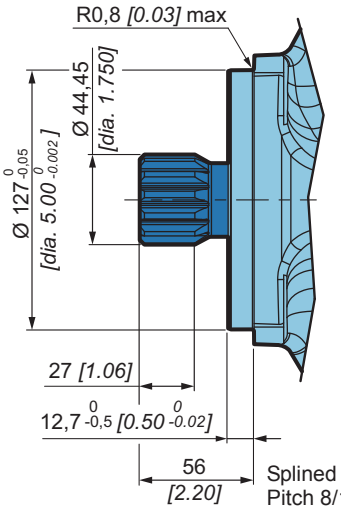

Splined ANSI B92.1-1996
Pitch 16/32" DP
Pressure angle 30°
Tolerance class: 5
Flat root side fit

### 3 — 23 teeth; Shaft torque: 1000 Nm *[8 851 in.lbf]*
(without radial force)



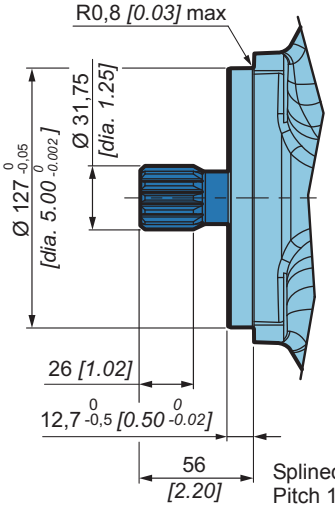

Splined ANSI B92.1-1996
Pitch 16/32" DP
Pressure angle 30°
Tolerance class: 5
Flat root side fit

### 5 — 13 teeth; Shaft torque: 1500 Nm *[13 276 in.lbf]*
(without radial force)




Splined ANSI B92.1-1996
Pitch 8/16" DP
Pressure angle 30°
Tolerance class: 5
Flat root side fit

### 6 — 14 teeth; Shaft torque: 600 Nm *[5 310 in.lbf]*
(without radial force)




Splined ANSI B92.1-1996
Pitch 12/24" DP
Pressure angle 30°
Tolerance class: 5
Flat root side fit

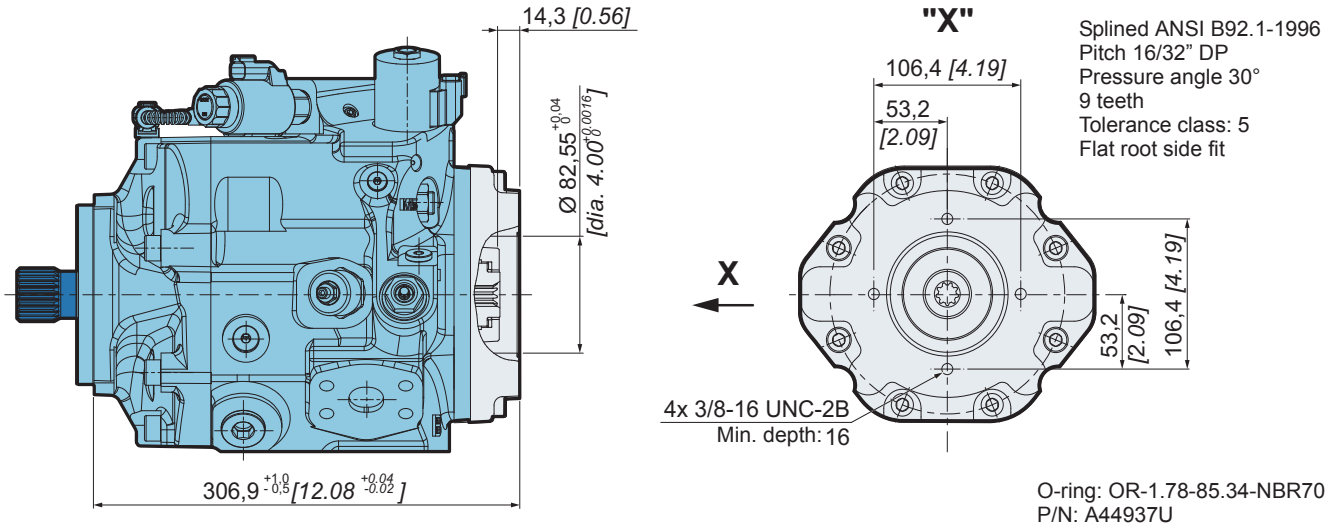
## Auxiliary mounting pad

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PW / PWe | 085 / 096 | D | M | C | O | H1 | H2 | G | L | A | F | S | | | | | P | C | E | B |

**0** **Without auxiliary mounting pad**

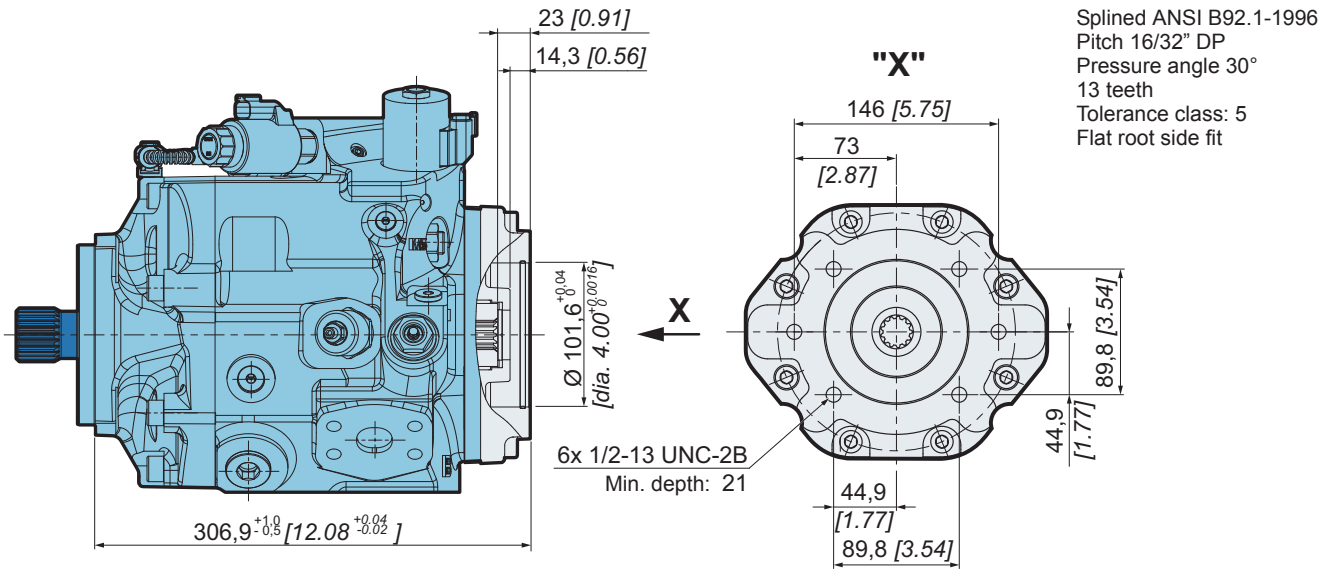
See chapter “Technical specifications”, for pump layout.

**1** **SAE-A; Coupling torque: 113 Nm *[1000 in.lbf];*** minimum active spline lenght: 10 mm *[0.39 inch]*




O-ring: OR-1.78-85.34-NBR70
P/N: A44937U

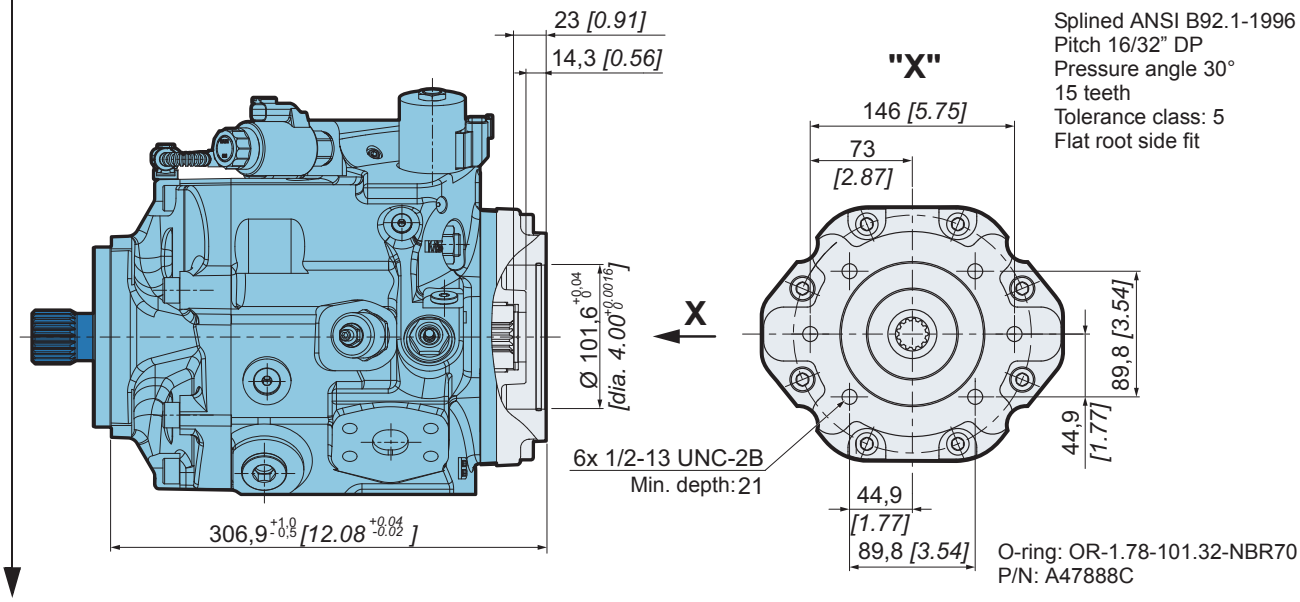
**2** **SAE-B; Coupling torque: 283 Nm *[2505 in.lbf];*** minimum active spline lenght: 12 mm *[0.47 inch]*



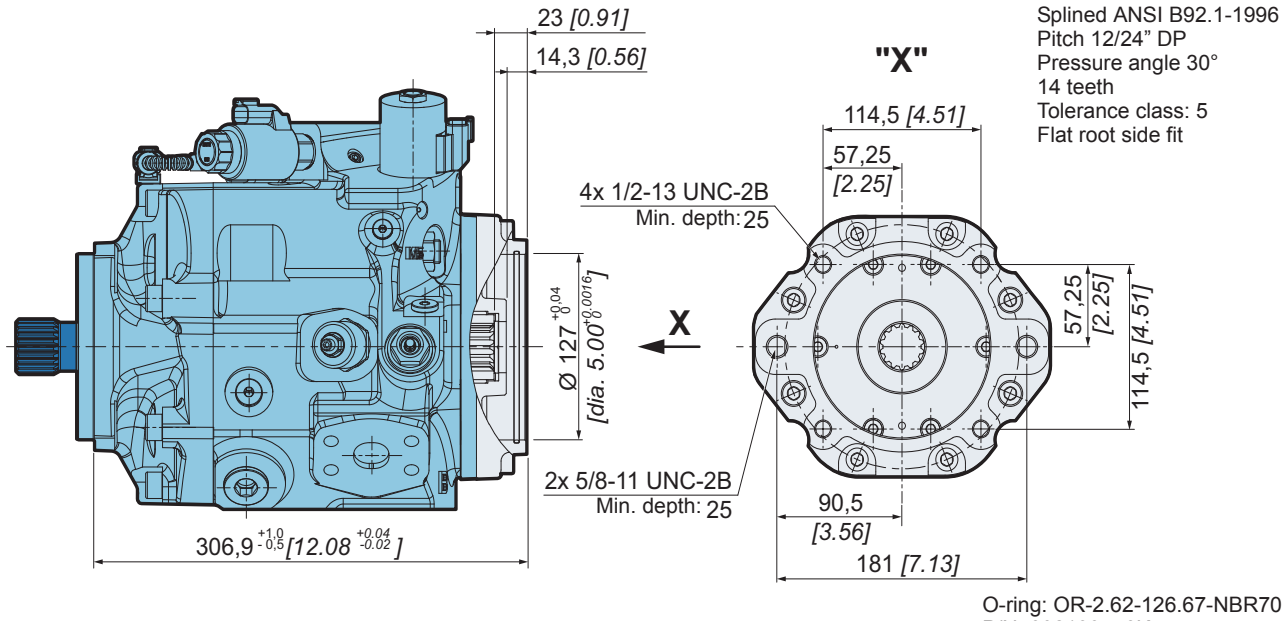

O-ring: OR-1.78-101.32-NBR70
P/N: A47888C

## Auxiliary mounting pad

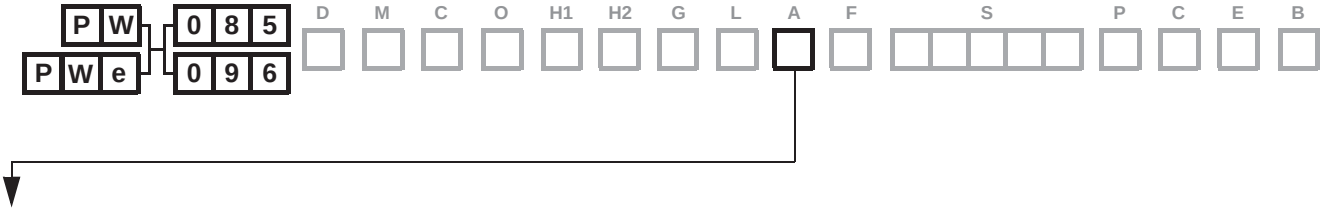

**3** **SAE-BB; Coupling torque: 407Nm *[3602 in.lbf];*** minimum active spline lenght: 13 mm *[0.51 inch]*



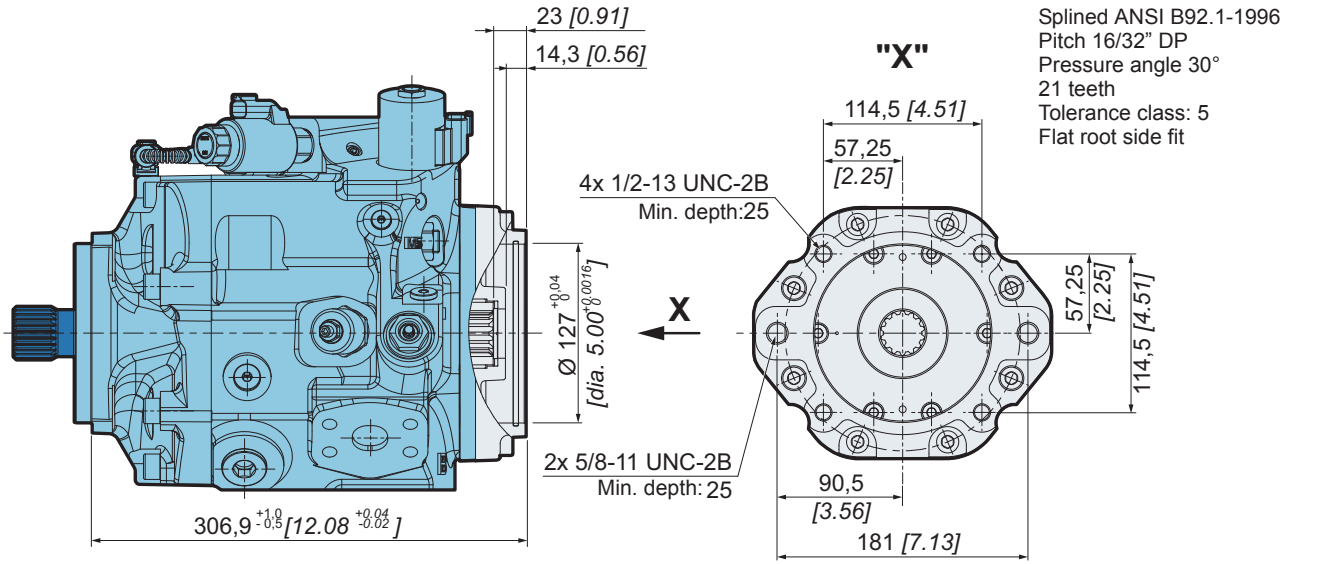

**4** **SAE-C; Coupling torque: 701 Nm *[6204 in.lbf];*** minimum active spline lenght: 14,5 mm *[0.57 inch]*



## Auxiliary mounting pad




| | |
|---|---|
| 5 | **SAE-C; Coupling torque: 918 Nm *[8125 in.lbf];*** minimum active spline lenght: 15 mm *[0.59 inch]* |




O-ring: OR-2.62-126.67-NBR70
P/N: 002130476K

# CONTROLS

## Solenoid control with feedback sensor and cut-off valve

### Features:

Proportional electronic control driven by Poclain Hydraulics electronic boxes:

- Our electronic control boxes control the displacement and the direction of the flow while monitoring permanently the functioning parameters of the engine and of the complete hydraulic system.
- Two contamination resistant (IP69K) solenoid valves controls the displacement and the direction of the flow.
- A sensor linked to the swash plate monitors permanently the actual displacement setting.

Control pressure cut-off valve:

- Ensures the safe return of pump to neutral position in case of electronic failure or control valves pollution.
- Ensures that machine will not move until proper activation of the pump control.

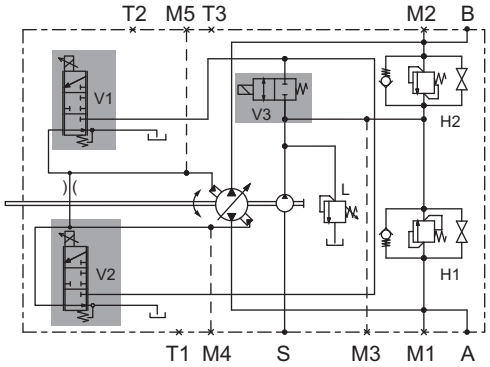
**For some special application where the pump is not used as main drive (e.g. assist drive) the cut-off valve is not mandatory, see chapter Options, "Without control pressure cut-off valve", page 58.**

| | Shaft rotation | | | |
|---|---|---|---|---|
| | Clockwise | | Counter clockwise | |
| Actuated solenoid | V1 | V2 | V1 | V2 |
| Servo cylinder | M5 | M4 | M5 | M4 |
| Port A flow | inlet | outlet | outlet | inlet |
| Port B flow | outlet | inlet | inlet | outlet |

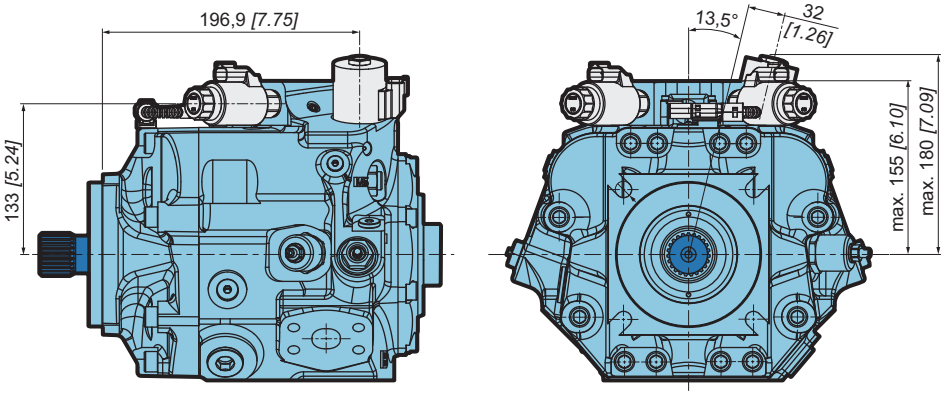
PW 085
PWe 096

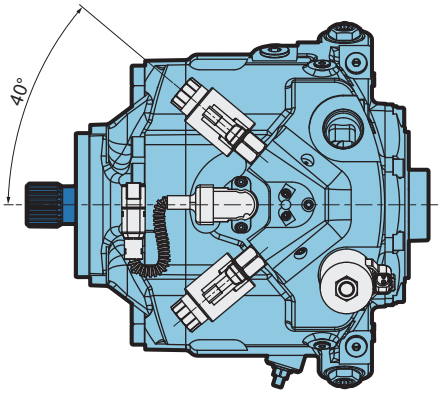
D M C O H1 H2 G L A F S P C E B

| Controls | |
|---|---|
| Solenoid control 12 V with feedback sensor and control pressure cut-off valve | A |
| Solenoid control 24 V with feedback sensor and control pressure cut-off valve | B |



## Solenoid control with feedback sensor and cut-off valve




| Position sensor specification | |
|---|---|
| Supply voltage | 5 VDC |
| Supply current | 0,012 A max. |
| Connector type | Deutsch DTM04-3P |
| Protection | IP67 |
| Sensor resolution | 8,5°/V |

| Connector wiring | |
|---|---|
| Pin 1 | Ground |
| Pin 2 | Output signal (0,4 to 4,5V) |
| Pin 3 | Supply voltage |

| Pump displacement | Feedback angle for max. displacement |
|---|---|
| PW/PWe 085-096 | 14° |

| Solenoids specification | | |
|---|---|---|
| Operating voltage | 12 VDC ± 10% | 24 VDC ± 10% |
| Resistance at 50°C *[122°F]* | 9,4 Ω | 37,2 Ω |
| Resistance at 20°C *[68°F]* | 6,4 Ω | 26,2 Ω |
| Rated current | 1,15 A | 0,59 A |
| Connector type | Deutsch DT04-2P | |
| Power | 22 W | |
| Protection | IP69K | |
| Mass | 0,24 kg *[0.53 lb]* | |

| Cut-off valves specification | | |
|---|---|---|
| Operating voltage | 12 VDC | 24 VDC |
| Resistance at 20°C *[68°F]* | 7,1 Ω | 28,5 Ω |
| Initial current draw | 1,7 A | 0,8 A |
| Connector type | Deutsch DT04-2P | |
| Power | 20,5 W | 18,2 W |
| Protection | IP69K | |
| Mass | 0,41 kg *[0.90 lb]* | |

## 3-pin DTM Deutsch connector

✔ for PW pump only

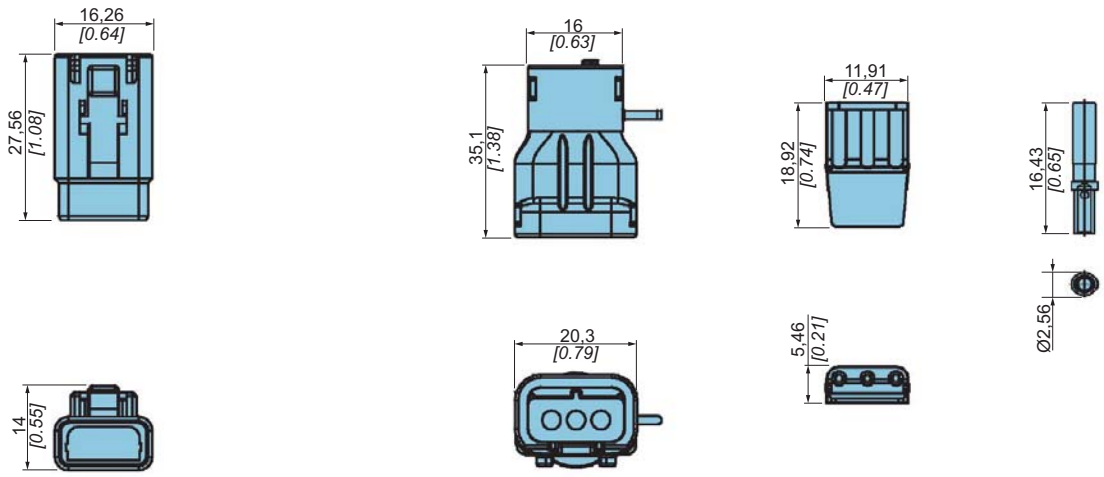
| Commercial name | KIT-CONNECT-DTM-3S-NW8.5 |
|---|---|
| Part number | B02468G |
| Compatibility | Position sensor |

| Features | | |
|---|---|---|
| Manufacturer | | Deutsch |
| Components | 1 Deutsch connector DTM | DTM 06-3S |
| | 1 Backshell 180° NW8.5 | 1028-005-0305 |
| | 1 Wedgelock | WM-3S |
| | 4 socket contact size 20 | 0462-201-20141 |
| Wire section | 0.2 to 0.5 $mm^2$ | |
| Cable diameter | 1.35 to 3.05 mm | |
| Operating temperature | -55°C to +125°C *[-40°F to +257°F]* | |
| Ingress Protection | IP6K9K | |

## Mounting tool

Crimp tool: HDT-48-00

## Layout



## 2-pin DT Deutsch connector

✔ for PW pump only

| Commercial name | KIT-CONNECT-2-PIN-DEUTSCH |
|---|---|
| Part number | A42310P |
| Compatibility | Electro valve |

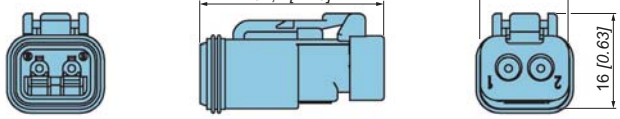
| Features | | |
|---|---|---|
| Manufacturer | | Deutsch |
| Components | 1x Deutsch connector DT | DT 06-2S |
| | 1x Wedgelock | W2S-P012 |
| | 3x socket contact | 0462-201-16141 |
| Wire section | 0.5 to 0.1 $mm^2$ | |
| Cable diameter | 2.23 to 3.68 mm | |
| Operating temperature | -55°C to +125°C *[-40°F to +257°F]* | |
| Ingress Protection | IP67 | |

## Mounting tool

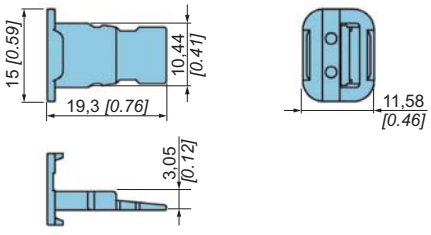
Crimp tool: HDT-48-00

## Layout

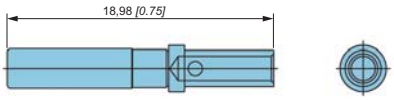
Connector




Wedgelock



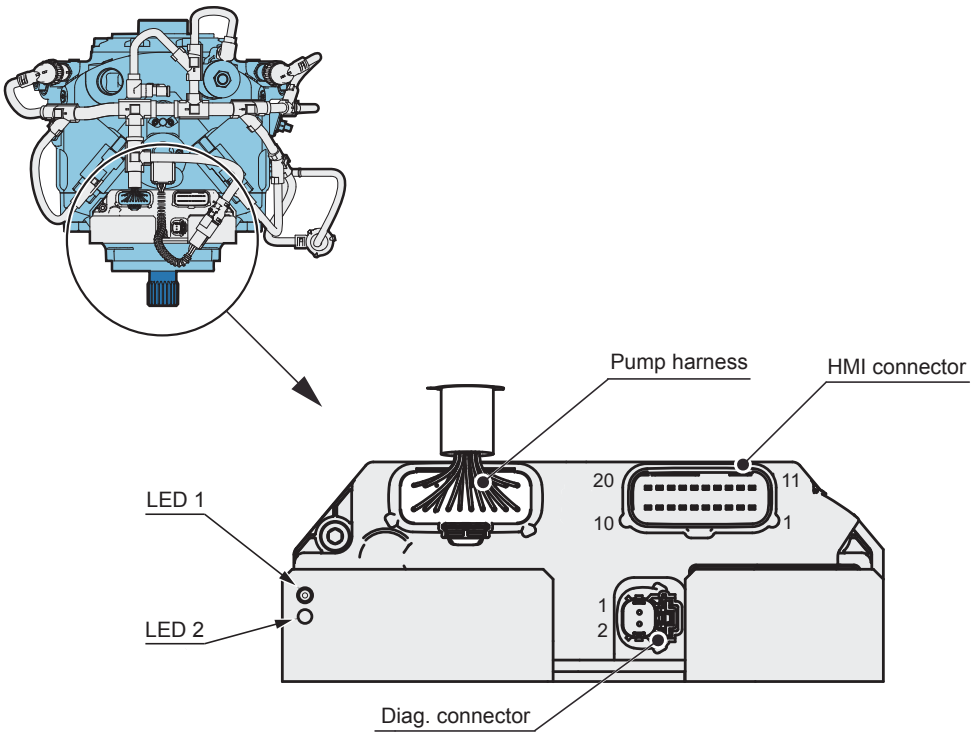

Socket contact



# PWE INSTALLATION

## PWe ECU description

- The pump is delivered with its ECU (Electronic control unit) and its harness assembled.
- The ECU is already programmed to manage the pump in according to the command interface.
- The pump management can be optimized in using PWe Configurator software.




**HMI connector**

| PIN | Name | Function | Wire gauge ($mm^2$) |
|---|---|---|---|
| 1 | DIGOUT_4 | Digital output 4 | 0,75 to 1 |
| 2 | DIGOUT_1 | Fault lamp | 0,75 to 1 |
| 3 | DIG_2 | Reverse_in | 0,35 to 0,5 |
| 4 | DIG_4 | Neutral_in | 0,35 to 0,5 |
| 5 | NC | Not connected | |
| 6 | ANA_6 | Inching/Braking pedal | 0,35 to 0,5 |
| 7 | CAN1L | Vehicle CAN 1 bus low | 0,35 to 0,5 |
| 8 | CAN1H | Vehicle CAN 1 bus high | 0,35 to 0,5 |
| 9 | AGND | Analog ground | 0,35 to 0,5 |
| 10 | VBAT - | Battery - | 1,5 to 2 |
| 11 | DIGOUT_3 | Not used | 0,75 to 1 |
| 12 | DIGOUT_2 | Brake lamp relay | 0,75 to 1 |
| 13 | DIG_1 | Forward_in | 0,35 to 0,5 |
| 14 | DIG_3 | P-brake_in | 0,35 to 0,5 |
| 15 | DIG_5 | Operator presence | 0,35 to 0,5 |
| 16 | ANA_5 | Travel pedal/Joystick/Inching | 0,35 to 0,5 |
| 17 | UN_1 | Pump speed signal | 0,35 to 0,5 |
| 18 | UN_2 | Joystick/Travel pedal | 0,35 to 0,5 |
| 19 | 5V SENSOR | 5V sensor supply | 0,35 to 0,5 |
| 20 | VBAT+ | Battery + | 1,5 to 2 |

**Diag. connector**

| PIN | Name | Function | Wire gauge ($mm^2$) |
|---|---|---|---|
| 1 | CAN2H | PH CAN bus high | 0,35 to 0,5 |
| 2 | CAN2L | PH CAN bus low | 0,35 to 0,5 |

## PWe ECU characteristics

| | |
|---|---|
| Operating voltage | 8 V to 32 V |
| Operating temperature | - 40°C to 100°C *[-40 °F to 212°F]* |
| Material | PA66 30% GF; Silicon (potting) |
| Mass | 0,225 kg ±10% [0,496 lb] ±10% |
| Ingress protection (with mating connectors mounted) | IP6K9K (ISO20653) |
| 12V system max current | 17 A |
| 24V system max current | 8,5 A |
| Performance level | Capacity to reach PL d level according to ISO13849:2006 standard |
| Mean Time To Failure (MTTF) | 162 years (duty cycle is 229 days of 8 hours) |
| Mean Time To Dangerous Failure (MTTFd) | 324 years |
| Diagnostic Coverage (DC) | 95.4 % |
| Category | 2 |
| Electrical protection | Over-voltage, reverse polarity (with fuse), ground and battery short circuit |
| ECU programming | Programming with a PC using the PHASES™-CT software application |
| ECU set-up | Set-up with the software PHASES™-CT |
| Digital inputs | 5 |
| Analog inputs (AN) | 7 |
| Universal inputs | 2 |
| HSD PWM outputs | 4 |
| HSD DIG 2,6A outputs | 2 |
| HSD DIG 0,5A outputs | 2 |
| Sensor supply 5V | 1 |

## PWe ECU environmental performances

| Type | Standard | Parameters |
|---|---|---|
| EC marking | 2004/108/EC | |
| Electro-Magnetic Compatibility | EN/ISO14982:2009 | Agricultural and forestry machines |
| Electro-Magnetic Compatibility | EN13309:2010 | Construction machines |
| Electro-Magnetic Compatibility | EN12895:2000 | Forklifts |
| E marking | 2004/104/EC | Automotive EMC directive |

## PWe ECU input characteristics

### Digital inputs

• These inputs are active in high side
• They are protected against short circuits to ground, battery and over voltage up to +48 V

| | |
|---|---|
| Input range | 0 to 32 V |
| Max voltage for low level | 1,75 V |
| Max voltage for high level | 3,25 V |
| Switch current | 10 mA under 28 V |

### Analog inputs

• These inputs are populated to perform 0-5V measurement.
• These inputs are protected against short-circuit to ground and battery.

| | |
|---|---|
| Input range | 0 to 5V |
| Input resistance | >170 kΩ |
| Resolution | 12 bits |
| Full scale accuracy | 1% |

### Universal inputs

| | |
|---|---|
| Input range | 1 Hz to 8500 Hz |
| Max voltage for low level | 1,65 V |
| Max voltage for high level | 3,85 V |
| Switch current in PNP mode | 15 mA (input at 28 V) |
| Switch current in NPN mode | 10 mA (input at 0 V, supply voltage at 28 V) |
| Accuracy | < 1% |

## PWe ECU output characteristics

### PWM outputs 2A at 12V (1A at 24V)

| These outputs can be configured in PWm mode and current control. | |
|---|---|
| DC voltage (ON state) | >(Battery voltage - 1V) |
| DC current control | 2 A max. at 12V and 1A max. at 24V |
| PWM frequency | 100 to 500 Hz |
| PWM duty cycle | 0 or 5% to 100%<br>Resolution of 0,6% |

### Digital outputs 2,6A (STOR 3/4) at 12V (1,3A at 24V)

| | |
|---|---|
| DC voltage (On state) | >(Battery voltage - 1V) |
| DC current | 2,6 A max.(inductive load) at 12V and 1,3A at 24V |

### Digital outputs 0,5A (STOR 1/2)

| | |
|---|---|
| DC voltage (On state) | >(Battery voltage - 1V) |
| DC current | 0,5 A max. (resistive load) |

### Sensor supply 5V output

| | |
|---|---|
| DC voltage (On state) | 5V ±2% |
| DC current | 200 mA max. |

### Communication

PWe controller has 2 CAN standard 2.0A or extended 2.0B buses, whose speed can reach 500 kb/s max.

CAN 1 is used to communicate with customer machine.
CAN 2 is used for downloading, diagnostic and communication with other Poclain Hydraulics components.

### LED

PWe controller has 2 LEDs for diagnostic:
LED 1 is green and is used to check that the power supply is ON.
LED 1 OFF: ECU not correctly powered or ECU problem.

| LED 2 is bi-colour (red of green) and is controlled by applicative software for diagnostic: |
|---|
| 5Hz red blinking: Safety error |
| 1Hz red blinking: System error |
| 1 green flash at 2Hz: pump stroked |
| 1 green flash at 1Hz: wait for initial condition (safety check) |
| Fixed green: pump in neutral |
| 1 orange flash 1Hz: Parameter load failure |
| 2 orange flash 1Hz: Wrong MAF |
| LED OFF: ECU problem |

**If some of these conditions are active simultaneously, the LED will light according to the first condition and then will be OFF for 0,5s and light again according to the second condition ...**



## Wiring

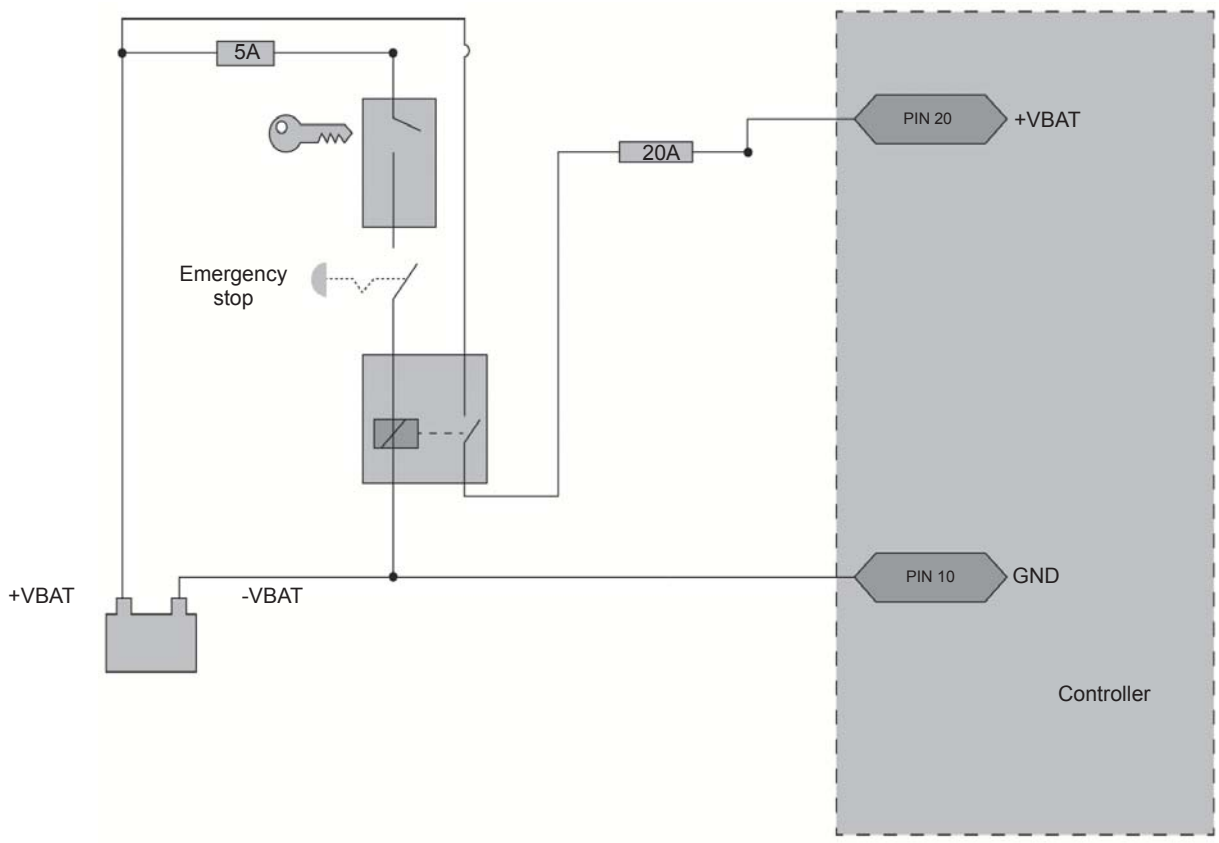
### CAN bus

The CAN bus must be wired using shielded or unshielded twisted pair. CAN bus must be wired according to SAE J1939-11 or SAE J1939-15.
If the PWe ECU is in end of the line, add a termination resistor of 120Ω. For this Poclain Hydraulics offers 120Ω connector kit (KIT-PLUG-120-DTM-2S: A52539H).

**CAN messages information:**

**All CAN messages information sent by Poclain ECU cannot be used for safety applications. For safety critical data by CAN, please contact your Poclain Hydraulics application engineer.**

### Supply

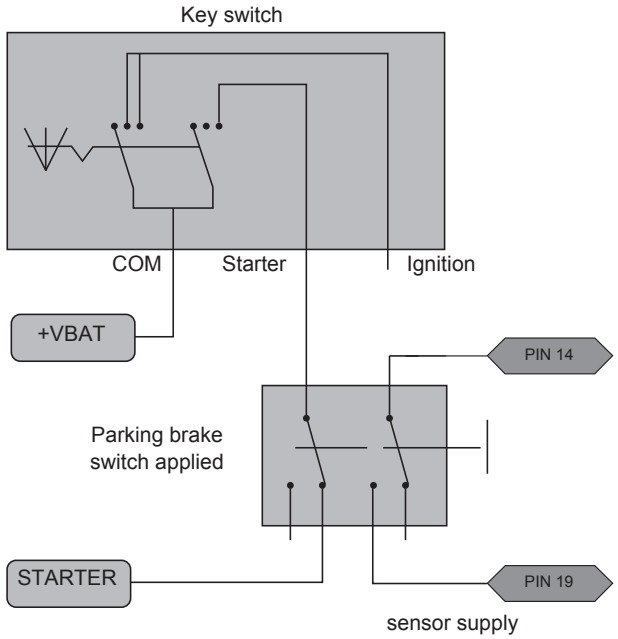



The correct wiring of the power supply pin (+VBAT) and pin connected to ground, is shown in previous figure. Power supply must be connected through an automotive fuse SAE J1284 20A.
A-GND pin is used as ground for analog sensors. It should not be connected to vehicle ground.

## Auxiliary functions

**Parking brake:**
To prevent vehicle movement during engine start, it is recommended to wire parking brake switch in serial with starter.

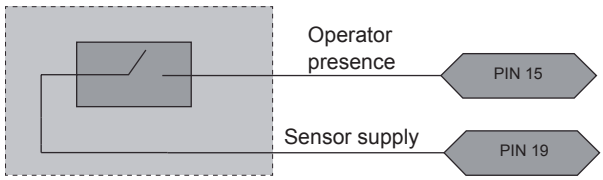
Diagram:



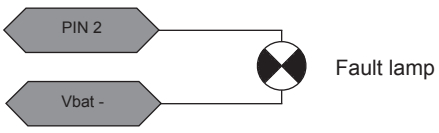

**Parking brake lamp:**
A lamp on the dashboard must give the real status of the parking brake.

The logic must be as follows:
• Lamp on, parking brake applied
• Lamp off, parking brake released

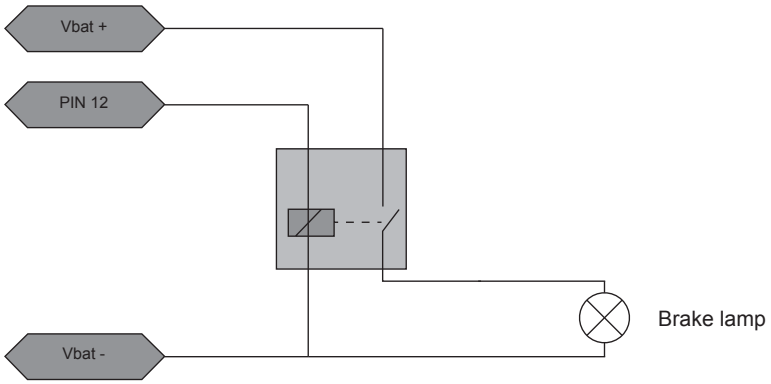
**Operator presence switch:**
Switch is wired between pin 15 and pin 19, it is open in when operator is not present.




**Fault lamp output:**
Output is wired between pin 2 and pin 12 and power ground (Vbat-).Lamp has to be relayed.



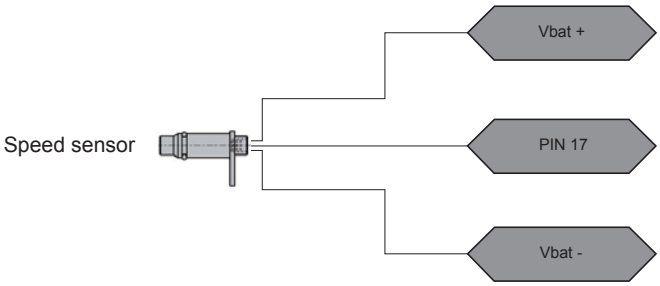
**Brake lamp output:**
Output is wired between pin 12 and power ground (Vbat-). Lamp has to be relayed.




**Vehicle CAN bus:**
CAN high is pin 8, CAN low is pin 7.

The CAN bus must be wired using shielded or unshielded twisted pair.
If the PWe ECU is in end of the line, add a termination resistor of 120Ω. For this Poclain Hydraulics offers 120Ω connector kit (KIT-PLUG-120-DTM-2S: A52539H).

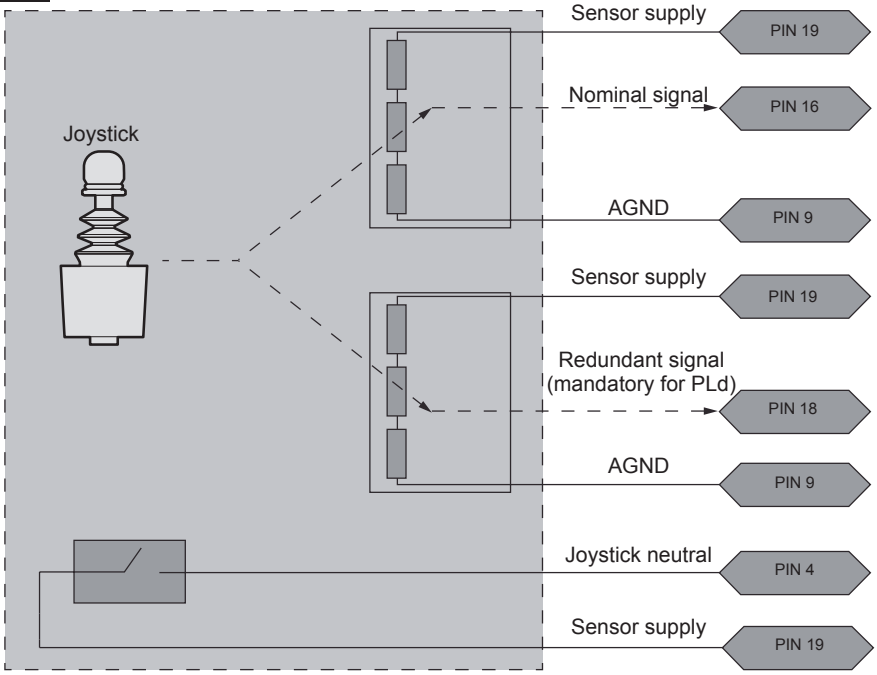
**External pump speed signal:**
An external pump speed signal can be wired on pin 17.




**The pin 17 is used only if there is no speed sensor wired directly on the pump (same input is used).**

## Pump command interface

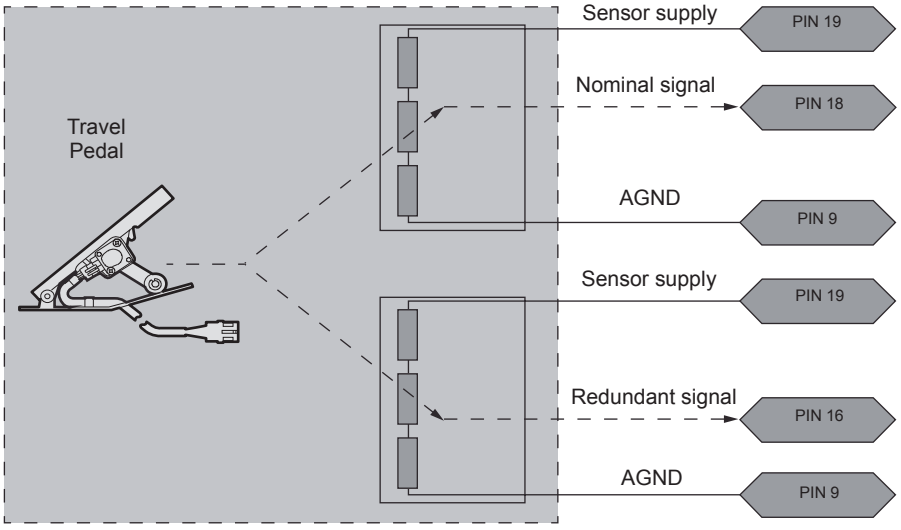
### Joystick


Safety requirements for compliance PLd, the joystick must:
• be powered by the +5V OUT and A_GND
• provide two independent signals:
- These signals must be between 0.5V and 4.5V to detect open circuits and short circuits.
- The source signal will vary from 2.5V to 4.5V for forward and 2.5V to 0.5V for reverse.
- Provide a neutral signal (contact closed in forward or reverse).
- Not operate (signal has to be out of range 0,5V-4,5V) when supply is in reverse polarity.

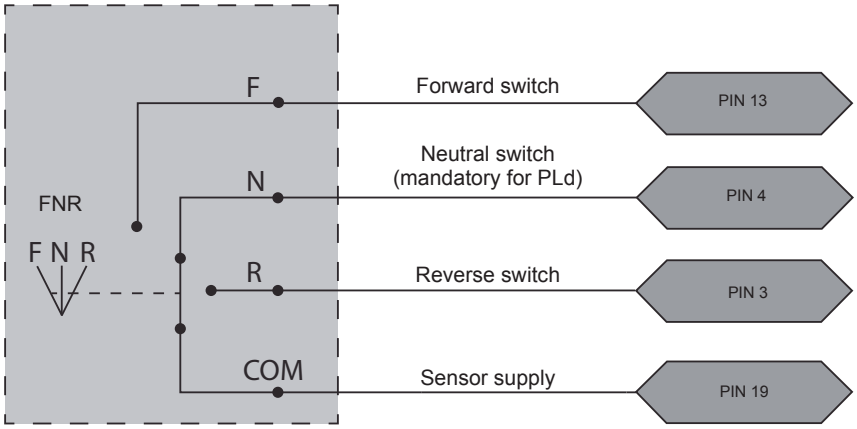
It is imperative to perform a calibration in operations of installation / commissioning and maintenance / repair on safety-critical inputs (pedal, joystick, ...), to take account of the complete measurement chain (physical implementation, sensor harness, controller ...).
The customer has to use a joystick for EMC directive of machine application field (Offroad/Onroad).

### Travel pedal

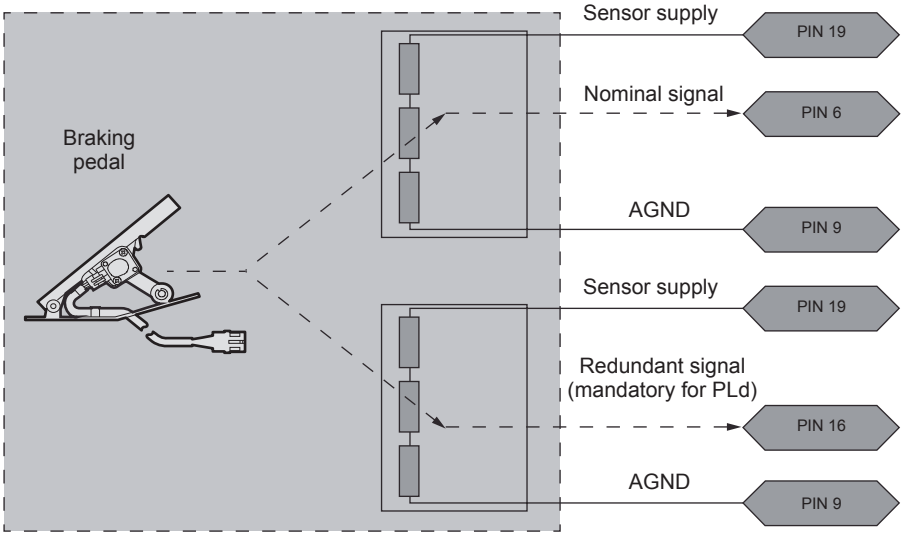
Safety requirements for compliance PLd, the sensor must:
• be powered by the +5V OUT and A_GND
• provide two independent signals:
- These signals must be between 0.5V and 4.5V to detect open circuits and short circuits.
- The signal source should be 0.5V when the pedal is released and 4.5V when the pedal is fully depressed.
- Not operate (signal has to be out of range 0,5V-4,5V) when supply is in reverse polarity.

It is imperative to perform a calibration in operations of installation / commissioning and maintenance / repair on safety-critical inputs (pedal, joystick, ...), to take account of the complete measurement chain (physical implementation,sensor, harness, controller ...).
The customer has to use a travel pedal for EMC directive of machine application field (Offroad/Onroad).



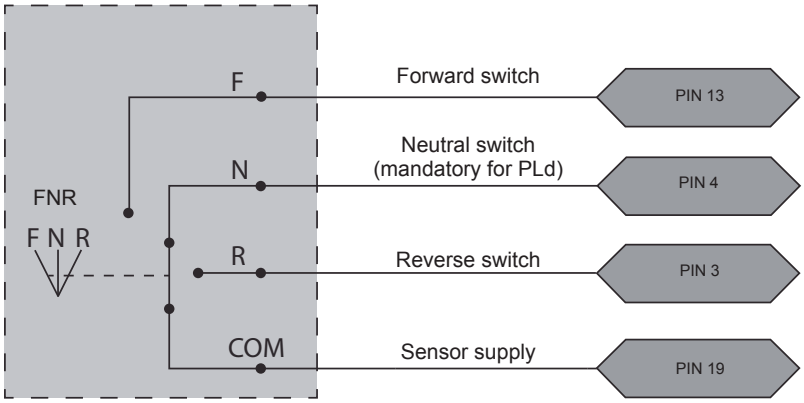

Safety requirements for compliance PLd, the sensor must:
• Provide three logic signals remain independent
• not be connected to loads (valve) in parallel
• have gold contacts

## DA-Like automotive

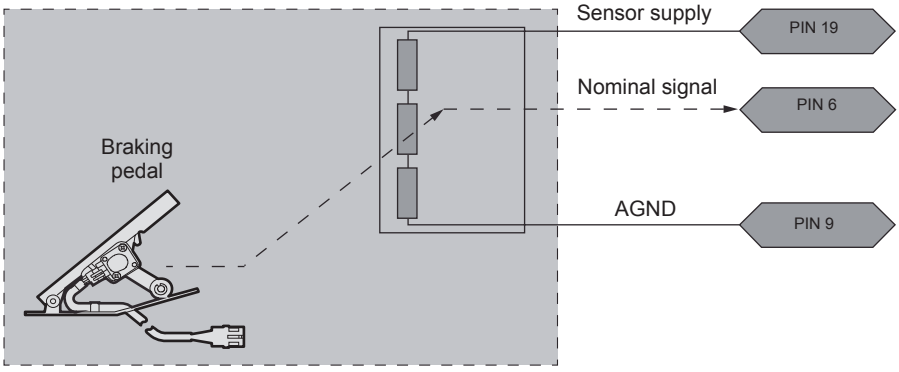

Safety requirements for compliance PLd, the braking pedal must:
• be powered by the +5V OUT and A_GND
• provide two independent signals:
- These signals must be between 0.5V and 4.5V to detect open circuits and short circuits.
- The signal source should be 0.5V when the pedal is released and 4.5V when the pedal is fully depressed.
- Not operate (signal has to be out of range 0,5V-4,5V) when supply is in reverse polarity.

It is imperative to perform a calibration in operations of installation / commissioning and maintenance / repair on safety-critical inputs (pedal, joystick, ...), to take account of the complete measurement chain (physical implementation,sensor, harness, controller ...).
The customer has to use a brake pedal for EMC directive of machine application field (Offroad/Onroad).




Safety requirements for compliance PLd, the sensor must:
• provide three logic signals remain independent
• not be connected to loads (valve) in parallel
• have gold contacts

## Braking-Inching pedal


Safety requirements for compliance PLd, the braking pedal must:
• be powered by the +5V OUT and A_GND
- This signal must be between 0.5V and 4.5V to detect open circuits and short circuits.
- The signal should be 0.5V when the pedal is released and 4.5V when the pedal is fully depressed.
- Not operate (signal has to be out of range 0,5V-4,5V) when supply is in reverse polarity.

It is imperative to perform a calibration in operations of installation / commissioning and maintenance / repair on safety-critical inputs (pedal, joystick, ...), to take account of the complete measurement chain (physical implementation,sensor, harness, controller ...).
The customer has to use a brake pedal for EMC directive of machine application field (Offroad/Onroad).



## Auxiliaries

### Main

**Characteristics**

| | |
|---|---|
| Commercial name | KIT-CONNECT-PWE-CUSTOMER |
| Poclain Hydraulics part number | B03982C |
| Function | SmartDrive™ CT PWe controller's Counter-part connectors. |
| Compatibility | Electronic transmission management with SmartDrive™ CT PWe controller. |

| Component | | Molex reference | Quantity | Wire gauge |
|---|---|---|---|---|
| Connector |  | 33472-2001 | x1 | |
| Pin |  | 33012-3001 | x2 | 1,5 to 2 mm² *[0.0023 to 0.0031 in²]* |
| Pin | | 33012-3002 | x4 | 0,75 to 1 mm² *[0.0011 to 0.0015 in²]* |
| Pin | | 33012-3003 | x14 | 0,35 to 0,5 mm² *[0.0005 to 0.0007 in²]* |
| Plug |  | 34345-0001 | x20 | |

| | |
|---|---|
| Insulation diameter | 1,5 to 2,5 mm *[0.05 to 0.098 in]* |
| Operating temperature | -40°C to 125°C *[-40°F to 257°F]* |

### Female communication connector (ECU connector counter-part)

**Characteristics**

| | |
|---|---|
| Commercial name | KIT-CONNECT-PWE-DIAG |
| Poclain Hydraulics part number | B03983D |
| Function | SmartDrive™ CT PWe controller's Counter-part connectors. |
| Compatibility | Electronic transmission management with SmartDrive™ CT PWe controller. |

| Component | | Molex reference | Quantity |
|---|---|---|---|
| Connector |  | 33471-0201 | x1 |
| Pin |  | 33012-3003 | x2 |

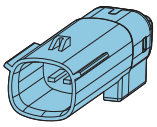
| | |
|---|---|
| Wire gauge | 0,35 to 0,5 mm² *[0.0005 to 0.0007 in²]* |
| Insulation diameter | 1,2 to 2,69 mm *[0.047 to 0.105 in]* |
| Operating temperature | -40°C to 125°C *[-40°F to 257°F]* |

## Tools

| Description | | Molex reference | Wire gauge |
|---|---|---|---|
| Crimping tool |  | 63811-5900 | 1,5 $mm^2$ to 2 $mm^2$ |
| Crimping tool |  | 63811-6000 | 0,35 $mm^2$ to 1 $mm^2$ |
| Pin extractor |  | 63813-1500 | |

## Male communication connector (for cabin usage interface)

| Characteristics | |
|---|---|
| Commercial name | KIT-CONNECT-MX2-M |
| Poclain Hydraulics part number | B26740P |
| Function | Extension of CT-PWe diagnostic male connector for cabin usage |
| Compatibility | Electronic transmission management with SmartDrive™ CT PWe controller. |

| Component | | Molex reference | Quantity |
|---|---|---|---|
| Connector |  | 33481-0201 | x1 |
| Pin |  | 33000-1003 | x2 |

| | |
|---|---|
| Wire gauge | 0,35 to 0,5 $mm^2$ *[0.0005 to 0.0007 $in^2$]* |
| Insulation diameter | 1,2 to 2,69 mm *[0.047 to 0.105 in]* |
| Operating temperature | -40°C to 125°C *[-40°F to 257°F]* |

**Machine safety recommendations**
Poclain Hydraulics has identified requirements for the controller, sensors and actuators to meet and satisfy the requirements of a performance level d according to ISO 13849-1 (PLd) at the vehicle system. To quantify for a performance level d (PLd) it is imperative to adhere to at least the following:

**A risk analysis must be conducted by the manufacturer to ensure the non-hazardous nature of the machine in case of failure on one of these components.**

**The safe state is opening of HSD and LSD (Pump coils). The customer must realize a safety analysis of the machine to check that there is no safety aspect due to the opening of the HSD and LSD (Pump back to neutral).**

**Installation and commissioning:**

**Upon system design and configuration, it could be needed to perform calibrations of safety critical inputs, to take into account the complete measurement chain (physical implementation, sensor, harness, controller…).**

**Maintenance and repair:**

**Any maintenance or repair of the controller shall be done according to the warranty terms. Otherwise, the integrity of the controller and the effectiveness of safety principles can not be guaranteed.**

**Precaution before maintenance and repair:**

**Before any maintenance or repair or decommissioning the controller must be disconnected from the power source, in particular before disconnecting interfaces connectors. To perform this operation, it is recommended to disconnect the battery fully after complete stop of the vehicle and its engine.**

**Operation after maintenance and repair:**

**After maintenance or repair of the machine, it is necessary to perform a calibration of the safety inputs.**

**Caution during electric welding:**

**The connectors on the controller and associated sensors must be disconnected during the electric welding process.**

**Pump:**

**The safety state of a hydrostatic transmission is stopped vehicle by a rapid and mastered return to neutral of the pump.**

**To do so, it is necessary to add:**
**• restrictors to be correctly sized depending on the application, the machine ... When using multi- displacements motors, provide a bypass valve for these retrictors.**
**• A cut-off valve, allowing to bypass the supply of the pump.**

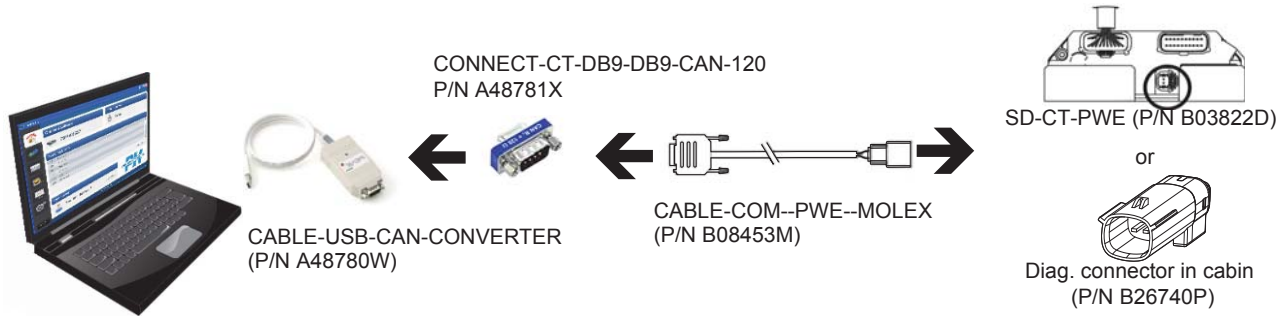
## PWe ECU Configurator

PWe ECU Configurator software enables you to configure electronic functions of your PWe pump.
It provides you a ".ct" file that you can use with PHASES CT software to configure your PWe pump.
PWe ECU Configurator application is free and can be downloaded at: http://phases.poclain-hydraulics.com/downloadcenter

"PWe ECU configurator" tool is used to select functions to be activated.
a "Ct file" is created

PHASES CT is used to :
- Download the "CT file" on PWe ECU.
- Adjust and control the operating parameters of the PWe ECU.
- Calibrate and to check the functioning of the sensors connected to the PWe ECU.
- Diagnose the possible malfunctions of the hydrostatic transmission by displaying the logical error log memorized by the PWe ECU.

Install the PHASES™ CT software (see installation guide n° A48679M).
Connect the SmartDrive™ CT controller to the PC by connecting the PC's USB to controller's communication connector (CAN bus link) via cable COM-CABLE-COM-PWE-MOLEX (P/N B08453M), SUBD9 connector with integrated 120Ω termination resistor and adapter CABLE-USB-CAN-CONVERTER (P/N A48780W). These cables are supplied with PHASES™ CT PWe kit P/N B12234W.

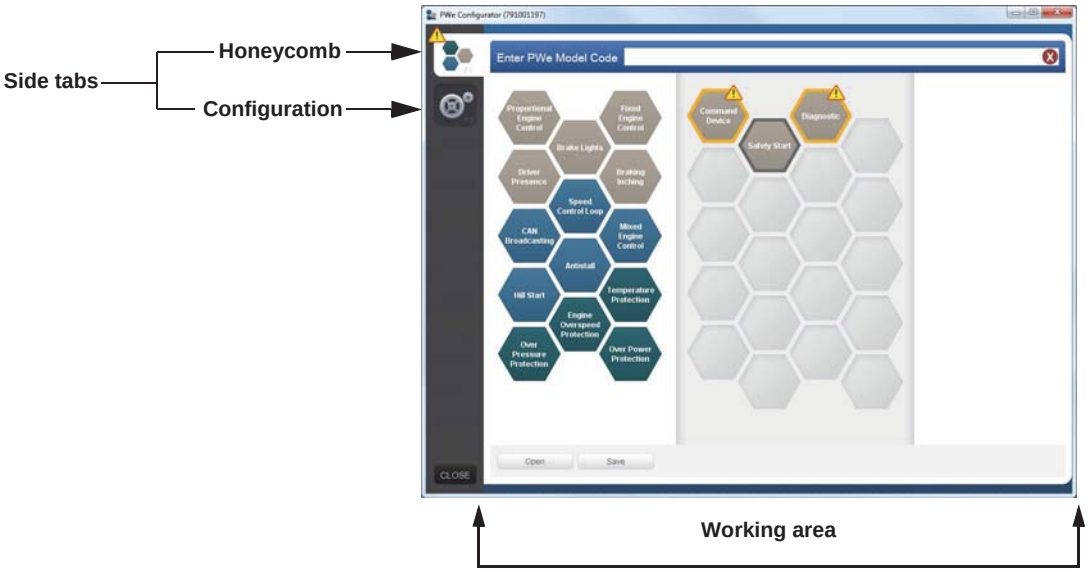



## PWe Configurator customization

The user interface provides a simple and intuitive access to the functions and its design is suitable for easy and comfortable use of PWe Configurator on a tablet.

The screen is divided into two areas:

- Side menu bar which allows navigation through the application.
- Working area where user can interact with his design...



**Side menu bar**

The side menu bar is always displayed and contains tabs allowing user to access software modules.

**Using software on a tablet holding it by left hand, user can navigate through modules with left thumb, keeping right hand free to interact with working area.**

**Working area**

The working area displays the module selected in the left side menu bar.

The modules are:

| | | |
|---|---|---|
| F1 | **Honeycomb** | Configure the PWe pump functionalities. |
| F2 | **Configuration module** | Allows to adjust the PC software. |

## PWe Configurator installation

**Required elements**

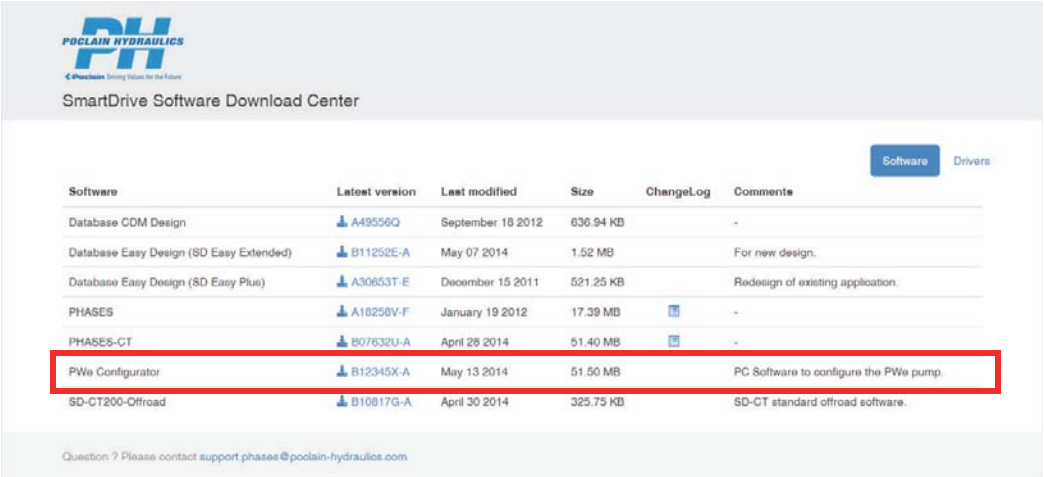
Before proceeding to installation, ensure that you have the following items:

• PC equipped with:
- Processor: 2 GHz minimum
- Memory (RAM): 2 GB minimum
- Hard disk: 200MB free space
- Windows 7
- Colour monitor with minimum resolution of 1024 x 768

**Download procedure**

You can download the last version of PWe Configurator on the web page:

http://phases.poclain-hydraulics.com/downloadcenter




**Software installation procedure**

- Close all active programs and deactivate any antivirus that may be running on the PC. Only Windows must be running.
- Run the executable software you download from the website and follow instructions.
- Restart the computer if it is requested.

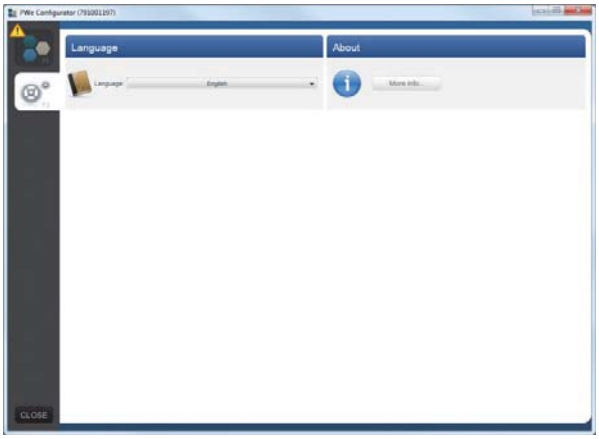
## Initial use and configuration

To launch PWe ECU configurator double click on desktop icon created during installation or use the start menu.

- The main screen will be displayed (see opposite).


Proceed as follows:

- In the side menu bar click on “Configuration” or press “F2” to display the configuration screen.
- Choose desired language from the collapsible menu.



## Description of functions

### Honeycomb

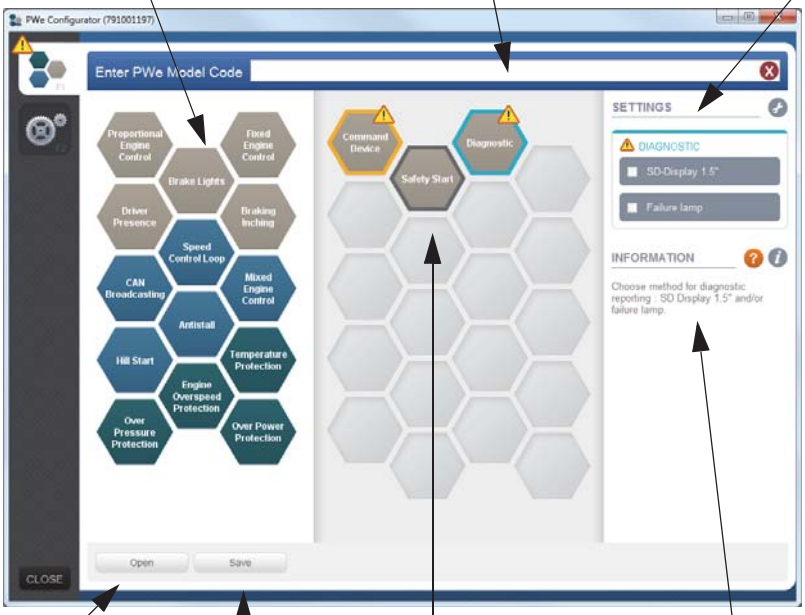
The honeycomb screen is automatically displayed when the software starts-up.

1. Enter the model code.
2. Choose and set your functions.
3. Save your configuration.

**Model Code**
Enter the model code of your PWe pump into this text field. Model code can be tipped using keyboard or directly pasted from clipboard. When the model code is complete the icon change

**Available functions**
These function can be dragged and dropped to the chosen function area.

**Settings**
Configure selected function.




**Open**
Open existing configuration.

**Information**
A short description about selected function.

**Chosen functions**
The configuration is completed when all selected function has been correctly configured and there is no more: icon.

**Save**
Save current configuration as ".des" file for partial configuration or ".ct" file for complete configuration. ".ct" file are used by PHASES CT to send configuration in PWe ECU.

## Packages

The color of hexagons determines in which packages they are available:

Standard package:

Driving package:

Protection package:

Disabled hexagon:


Mandatory hexagon:


Configuration needed:


Selected / Under configuration:

## Hexagon signification

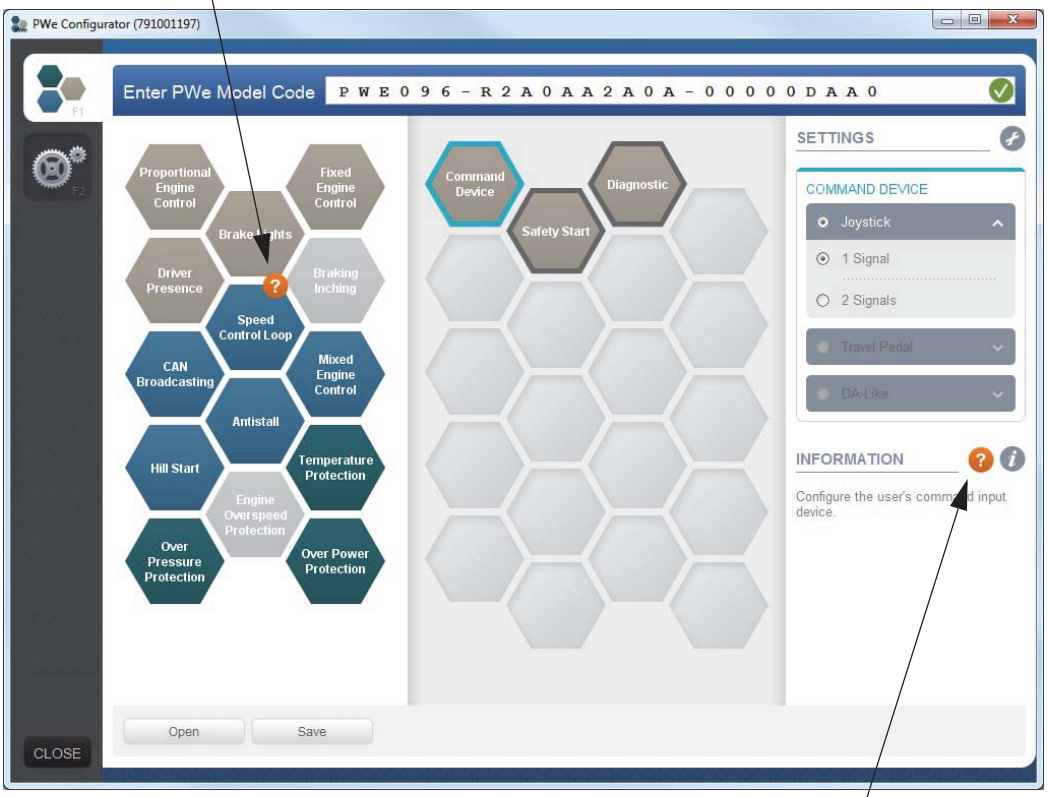
Hexagon concered by configuration (not chosen):


Hexagon concered by configuration (chosen):


## Help

Documentation about functions is available by clicking on the ? icons.

**Help icon**
This help icon opens documentation about the clicked function in the available function area.




**Help icon**
This help icon opens documentation about the function selected in the chosen function area.

## File generation

PWe Configurator can generate two types of files:

- **".des"** is generated when the configuration is not complete. This file can be used to save and load partial configuration including model code, function activated and options selected. **This file cannot be used with PHASES CT to configure the PWe pump.**
- **".ct"** is generated when the configuration is complete. This file can be used to save and load configuration including model code, function activated and options selected. **Use this file with PHASES CT to configure the PWe pump.**

The configuration is completed when the model code entered is completed and to act:

Model code not completed:


Model code completed:


When the model code is complete and design is complete:

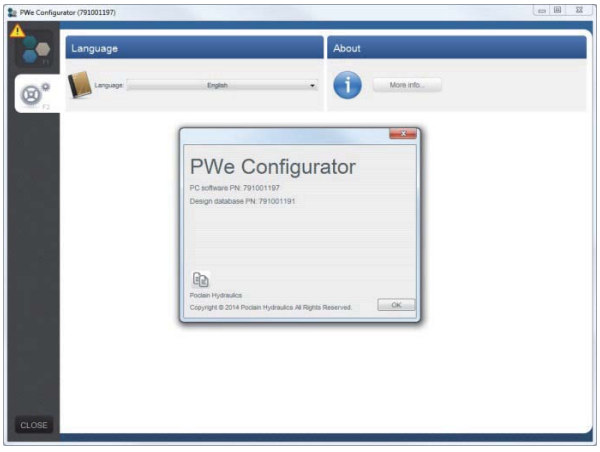
honeycomb button has to be like this: 


and not like this: 


## Configuration module

In the configuration module it´s possible to change language and display part numbers (PN).
To see part numbers of PC software and database proceed as follows:

- In the side menu bar click on **{Configuration}** or press **<F2>** to display the configuration screen.
- Click on **[More info...]**. Desired information are displayed in opened window.



# PWE PACKAGE DESCRIPTION


| | Software packages |
|---|---|
| A | Standard package |
| B | Standard + Driving packages |
| C | Standard + Protection packages |
| D | Standard + Driving + Protection packages |
| E | CAN slave |

| Acronym | Definition |
|---|---|
| ECU | Electronic control unit |
| CAN | Control Area Network (high speed serial communication bus) |
| EMC | Electromagnetic compatibility |
| I/O | Input/Output |
| J1939 | Standard SAE CAN - protocol for agricultural vehicle |
| SD | Poclain Hydraulics transmission controller |
| TP | Travel pedal |
| LimpMode | Minimum drive while failure |

## List of functions

### Standard package

Start-up check (1)
Command device (travel pedal, joystick or DA-Like) (1) (2)
Proportional engine control
Fixed engine control (adjustable by Display 1.5″)
Driver presence
Brake lights
Braking/Inching management
Diagnostic (by failure lamp or Display 1.5″) (1) (3)

### Driving package

Antistall
Hill start
CAN broadcasting
Speed control loop (mode deactivable by Display 1.5″)
Mixed (Automotive or Fixed) engine control (change by Display 1.5″)

### Protection package

Overpressure protection
Overpower protection
Engine overspeed protection
Temperature protection

### CAN slave

**(1)** Functions activated by default.
**(2)** By default, command device selected in the model code is 1 signal device with F/R direction switches (in case of travel pedal).
**(3)** By default, diagnostic is done with failure lamp.

## Anti-stall

### Aim of the function

Prevents the engine from stalling.

### Description

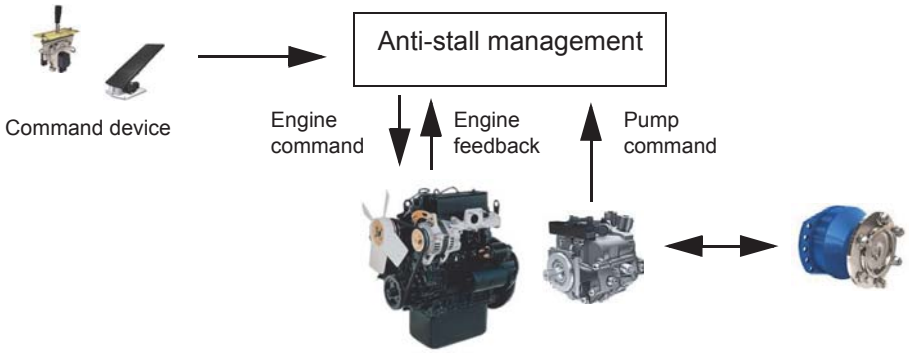
PWe ECU monitors engine speed.
- When engine speed is lower than expected, PWe ECU reduces pump displacement, thus torque needed by pump.
- When engine speed is back to its expected value, PWe ECU gently drives the pump to recover driver command.

### Ergonomics

Driver uses standard joystick or pedal to require machne to move.

### Inputs/Outputs

- CAN Bus




## Brake lights

### Aim of the function

Switches on and off the brake lights.

### Description

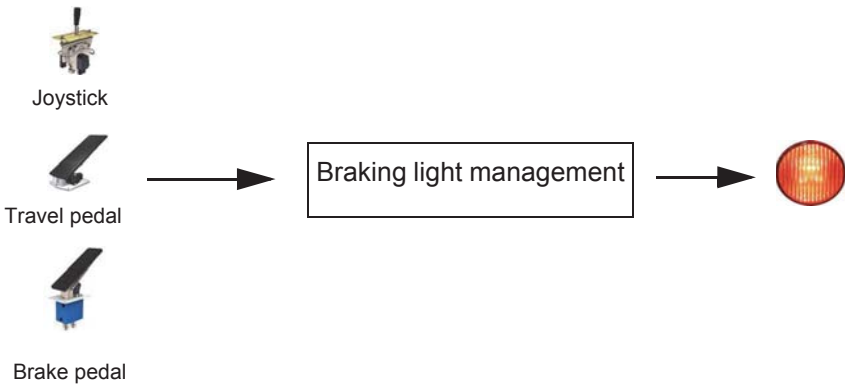
PWe ECU monitors machine acceleration and deceleration and - if appropriate - the braking command. When deceleration overpasses defined level or when driver braking request is detected, PWe ECU switches on the brake lights.
PWe ECU switches off the brake lights when deceleration is lower than defined level and when there is no more driver braking request.

### Ergonomics

Driver uses standard joystick, pedal or DA-like, and if present the braking pedal, to drive the machine. When appropriate, PWe ECU switches on the brake lights.

### Inputs/Outputs

- Driver command interface: Joystick, pedal or DA-like, brake pedal input if present.
- 1 digital output to drive brake lights relay.



## Driver presence

### Aim of the function

Check that driver is present. Stop the machine if needed.

### Description

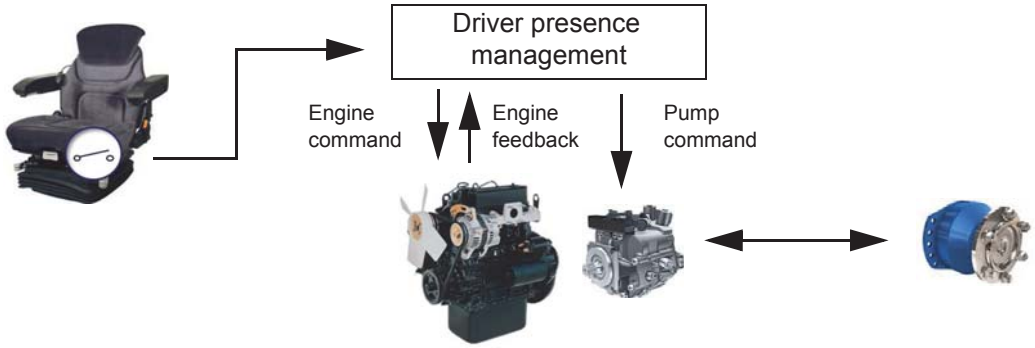
PWe ECU checks that driver is present thanks to a seat switch.
When PWe ECU detects that driver is not on the seat, PWe ECU stops the machine.

### Ergonomics

When driver leaves his seat, machine stops accordingly to a parameter defined ramp. If driver is back before machine has stopped, to avoid machine acceleration, brake security loop is engaged. The operator will first have to bring the joystick or travel pedal back to the position matching the current vehicle speed to recover the full control of the speed.

### Inputs/Outputs

• 1 digital input for reading the seat switch.




## Temperature protection

### Aim of the function

Protect the hydrostatic transmission against over temperature to preserve components lifetime.

### Description

PWe ECU monitors temperature in transmission.
When temperature overpass a limit defined with a parameter, PWe ECU reduces machine speed to recover acceptable temperature.

Machine speed reduction is managed thanks to: • A reduction of the pump displacement.
• A reduction of the engine command.

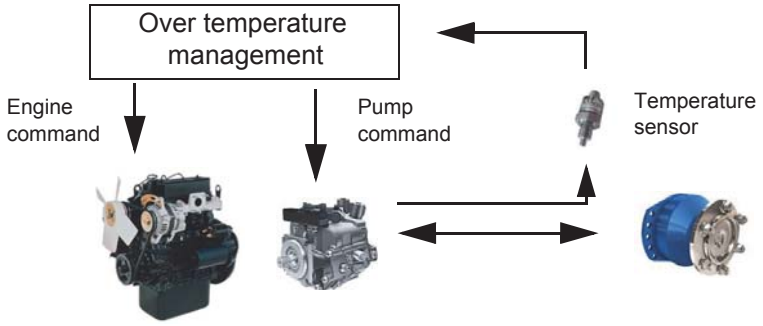
The reduction ratios values are set by parameters.

### Ergonomics

When system recovers acceptable temperature, reduction of machine speed is not more needed.
To avoid machine acceleration a brake security loop is engaged.The operator will first have to bring the joystick or travel pedal back to the position matching the current vehicle speed to recover the full control of the speed.

### Inputs/Outputs

• 1 analog input to read temperature sensor.



## Over pressure protection

### Aim of the function

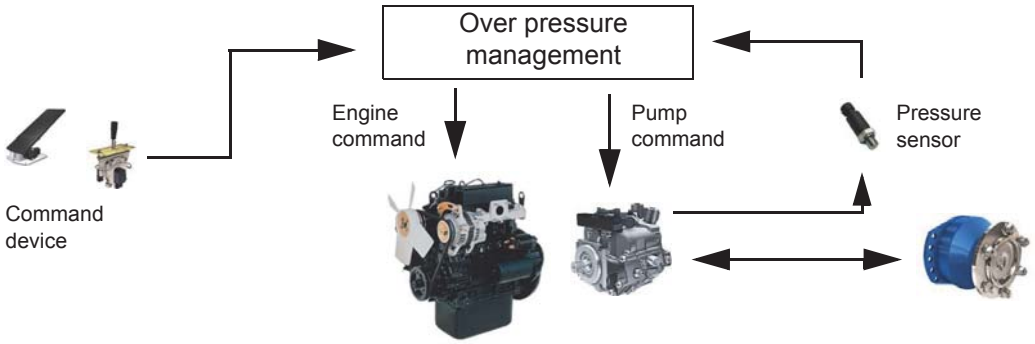
Check that driver is present. Stop the machine if needed.

### Description

PWe ECU monitors pressure delivered to the transmission.
When pressure overpass the limit defined with a parameter, PWe ECU reduces pump displacement to recover acceptable pressure.
It works in the same way as hydraulic flow cancellation (Ipor valve).

### Inputs/Outputs

- 1 analog input to read the pressure sensor in the hydraulic circuit.
- 1 analog input to read the pressure sensor on reverse line of the hydraulic circuit.




## Over temperature protection

### Aim of the function

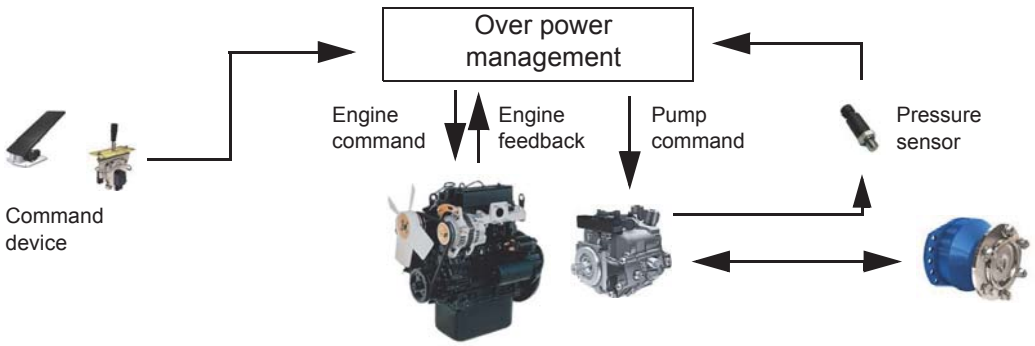
Protect the hydrostatic transmission against overpower.

### Description

PWe ECU monitors pressure and pump speed to compute power delivered to the transmission.
When power overpass the limit defined with a parameter, PWe ECU reduces pump displacement to recover acceptable power.
In case of multiple motors displacement configurations, one limit will be defined for each motors displacement with parameters.
Over power protection is active in forward and reverse: Two pressure sensors and one engine/pump speed sensor are needed.

### Inputs/Outputs

- 1 analog input to read the pressure sensor in the hydraulic circuit.
- 1 analog input to read the pressure sensor on reverse line of the hydraulic circuit.
- CAN Bus or 1 frequency input for pump speed sensor.



## Engine over speed protection

### Aim of the function

Protect the engine against overspeed.

### Description

PWe ECU monitors motor/pump speed.

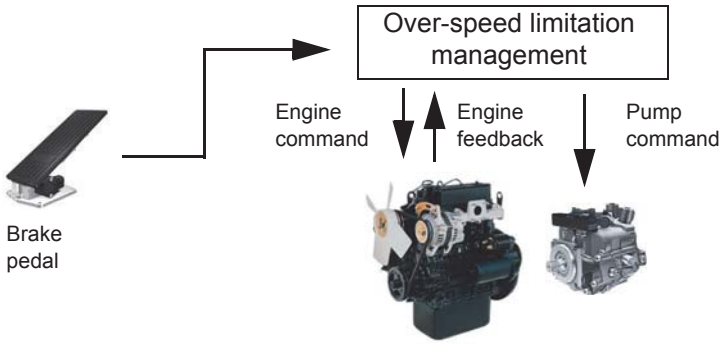
When engine speed overpass a limit defined with a parameter, PWe ECU will limit hydrostatic deceleration to recover acceptable engine speed.

### Ergonomics

According to engine speed, ramp of deceleration will be adjusted (time to decelerate is increased) to limit hydrostatic deceleration. Deceleration will be automatically adjusted to the engine braking performances whatever is the slope or the load of the machine. To ensure that the driver will be able to stop the machine, a braking device is mandatory (braking/inching or combined braking).

### Inputs/Outputs

- CAN Bus or 1 frequency input for pump speed sensor.
- 1 analog input for braking pressure sensor or braking pedal sensor.




## Diagnostic

### Aim of the function

Give driver feedback on transmission status.

### Description

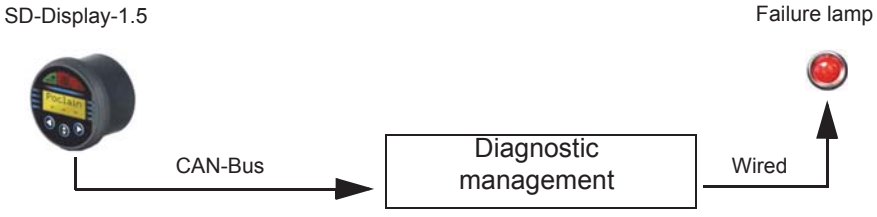
PWe ECU detects errors on the system and informs the user.

### Ergonomics

| | | |
|---|---|---|
| Two configurations: | Failure lamp: | • Blinking in case of error. |
| | Display: | • Displays error code and cause. |
| | | • Displays transmission information (speed, power, ...). |

### Inputs/Outputs

- 1 digital output for failure lamp.
- CAN bus for display.



## Command device

**Aim of the function**

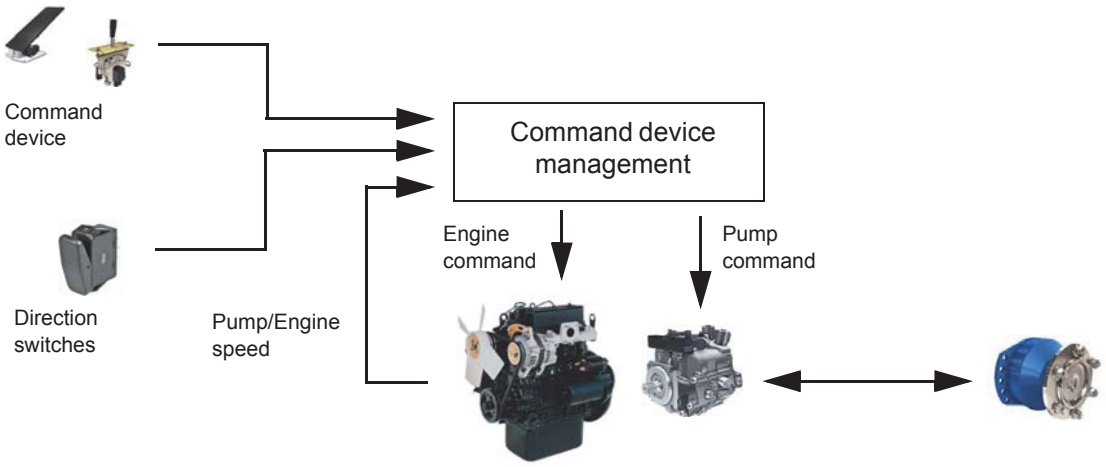
Define user ergonomics.

**Ergonomics**

| | |
|---|---|
| Possibility to select: | • Travel pedal (1 signal or 2 signals for redundancy) associated with forward/reverse direction switches or forward/neutral/reverse direction switches (for redundancy). |
| | • Joystick (1 signal or 2 signals for redundancy). |
| | • DA-like (pump speed defines pump displacement). A braking is mandatory to ensure deceleration if engine stays at high speed. |

**Inputs/Outputs**

| | |
|---|---|
| Joystick: | • 1 analog input to read the joystick or 2 analog inputs for redundancy.<br>• 1 digital input for joystick neutral switch. |
| Travel pedal: | • 1 analog input to read the travel pedal or 2 analog inputs for redundancy.<br>• 2 digital inputs for forward/reverse or 3 digital inputs for forward/neutral/reverse. |
| DA-like: | • 1 frequency input for pump speed sensor.<br>• 2 digital inputs for forward/reverse or 3 digital inputs for forward/neutral/reverse. |



## Start-up check

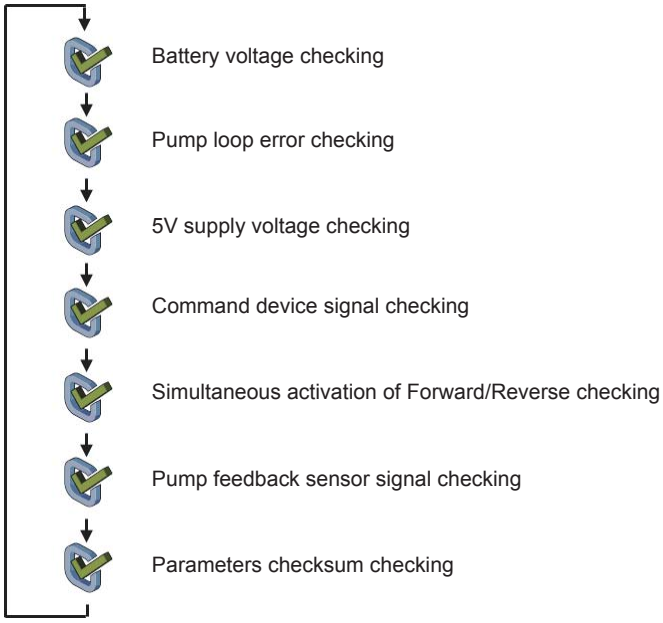
### Aim of the function

Ensure that all conditions are valid before making machine move after a powering up.

### Ergonomics

Ensures that after PWe ECU powering up, embedded software checks PWe ECU supply voltage, internal supply voltage, command device, direction switches, pump feedback and parameters values (all at the same time).

Ensures that after PWe ECU powering up, command device is seen at 0% and the direction switches are in neutral (all at the same time).




### Check of battery voltage

An error occurs if battery voltage is below 9V or above 30V.

### Pump loop error

An error occurs in case of difference between pump command and real displacement of the pump based on calculation using pump feedback sensor. The machine stops.

### Check of 5V supply

An error occurs if the 5V supply provided by the PWe ECU is below 4.8V or above 5.2V. The machine stops.

### Check Travel pedal or Joystick pedal

An error occurs if the signal from Travel Pedal or Joystick is below 0.25V or above 4.75V. The machine stops.

### Simultaneous activation of Forward, Neutral and Reverse switches

These actions are done when two switches (or more) are in the same state:

- Deceleration of machine according ramp.
- Error activation on direction switches

### Check of pump feedback sensor signal

An error occurs if the signal from the feedback sensor is below 0.25V or above 4.75V. The machine stops.

### Check of parameters checksum

An error occurs in case of parameter checksum or calibration value checksum. Then machine stay at stop.

## Hill start

### Aim of the function

Prevent any rollback when starting in a slope.

### Description

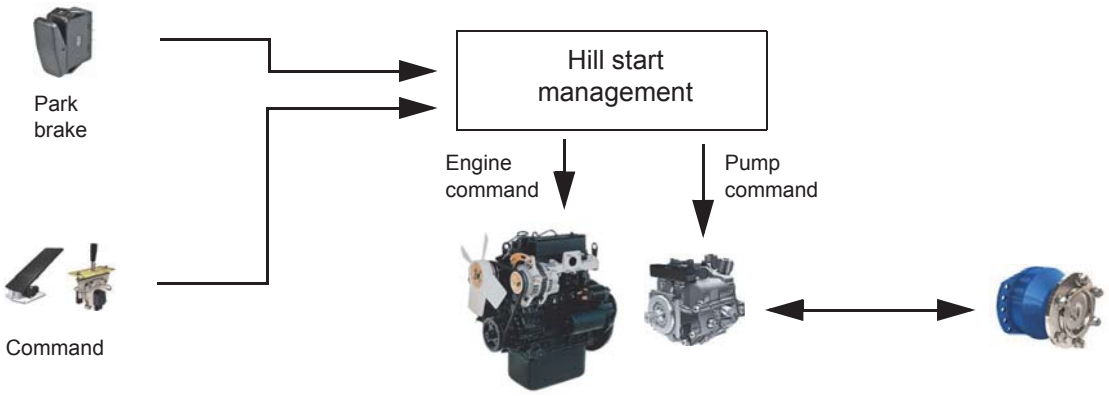
PWe ECU makes a jump on pump displacement to compensate leakages due to slope.

### Ergonomics

To activate hill start, driver must apply the park brake, provide a command device and then remove park brake.

### Inputs/Outputs

- 1 analog input for Travel pedal or Joystick.
- 1 digital input for the park brake.




## Proportional engine control

### Aim of the function

Drive engine speed proportionally to the command device.

### Description

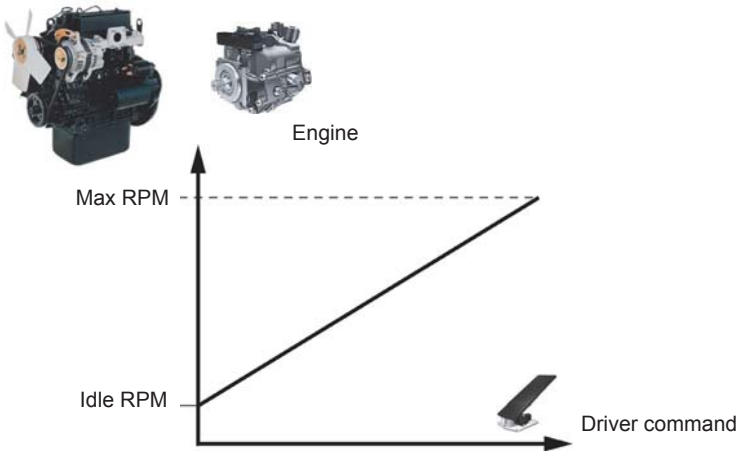
Engine is controlled from minimum to maximum speed (parameters) proportionally to command device position.

### Ergonomics

Driver uses command device to manage pump displacement and engine speed simultaneously.

### Inputs/Outputs

- CAN bus for engine (J1939 protocol).
- Command device: joystick or pedal.



## Fixed engine control

### Aim of the function

Machine translation is managed with fixed engine speed.

### Description

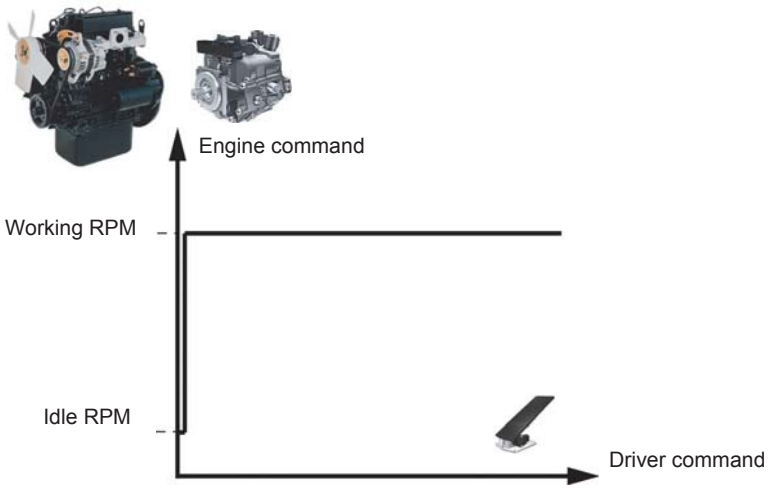
When driver requests the machine to move, PWe ECU drives the engine from idle speed to fixed speed. PWe ECU adjust machine speed with pump displacement only. After machine stops, PWe ECU waits for a parameter defined delay, then drives the engine speed to its idle speed.

### Ergonomics

- Driver uses standard joystick or pedal to require machine to move.
- Driver uses a display to set the desired speed for fixed engine control.

### Inputs/Outputs

- Command device: joystick or pedal.
- CAN bus for engine (J1939 protocol).
- CAN bus for display.



## Mixed engine control

### Aim of the function

Possibility for driver to select fixed engine control or a proportional engine control.

### Description

• Fixed engine control: when driver requests the machine to move, PWe ECU drives the engine from idle speed to fixed speed. PWe ECU adjusts machine speed with pump displacement only. After machine stops, PWe ECU waits for a parameter defined delay, then drives the engine speed to its idle speed.

• Proportional engine control: engine is controlled from minimum to maximum speed (parameters) proportionally to command device position.

### Ergonomics

Driver uses display to select between fixed engine control and proportional engine control.

• For proportional engine control: driver uses command device to set machine and engine speed simultaneously.

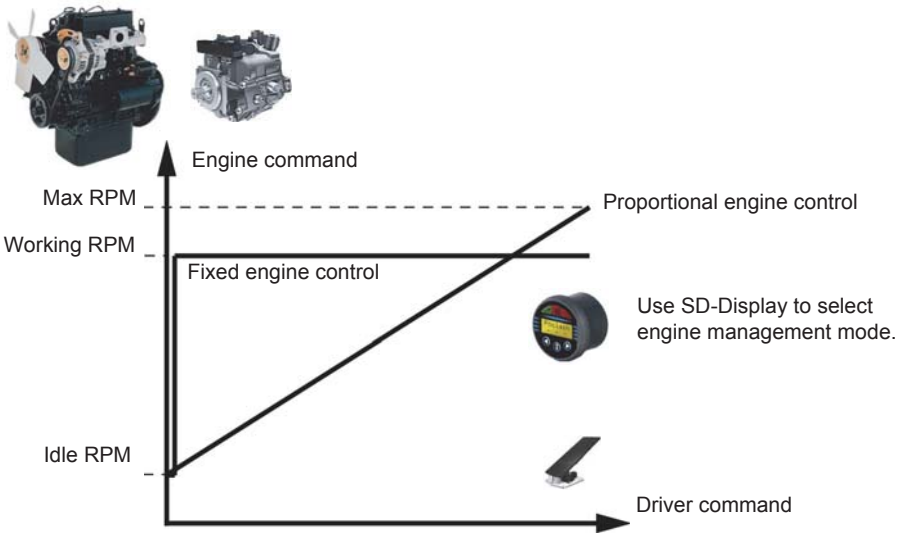
• For fixed engine control: driver uses standard joystick or pedal to require machine to move and uses a display to set the desired speed.

### Inputs/Outputs

• Command device. joystick or pedal.

• CAN bus for engine (J1939 protocol).

• CAN bus for display.



## CAN broadcasting

**Aim of the function**

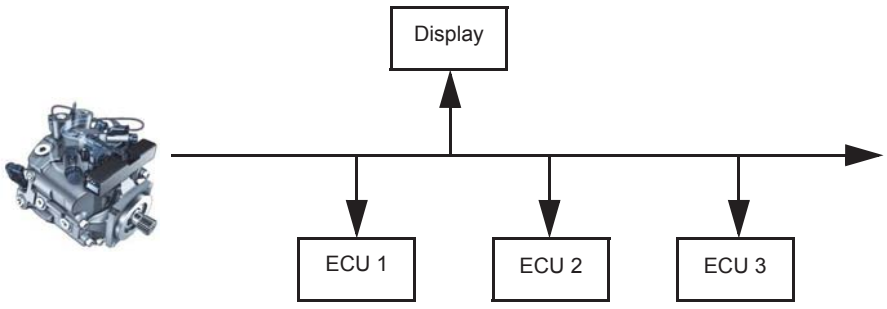
Send transmission information through CAN bus for driver display and diagnostic purpose.

**Description**

| | |
|---|---|
| Send transmission information accordingly to J1939: | Pump command |
| | Pump flow |
| | Pump speed |
| | Driver command |
| | Brake command |
| | Inching command |
| | High pressure A |
| | High pressure B |
| | Machine speed |
| | Mode |
| | Direction |
| | Power |
| | Over power protection status |
| | Over pressure protectin status |
| | Anti-stall status |
| | Engine overspeed status |
| | Speed control loop status |
| | Temperature protection status |
| | Error codes |

**Inputs/Outputs**

• CAN bus (J1939 protocol).



**CAN Bus J1939 standard**

This function builds CAN Bus frames following J1939 standard and puts these frames on the bus. These frames can be read by customer´s CAN bus display. These frames are sent each 40ms ne frame, so 5 frames are repeated each 200ms. Sending of these frames can be disabled/ enabled by parameter “CAN_J1939”.

| PH SPN | Signal Name | Representation | Length | Limits (Range) | Notes |
|---|---|---|---|---|---|
| 0 | Pump1 Command | H | 2 bytes | 0 to 65535 cc | |
| 1 | Pump2 Command | H | 2 bytes | 0 to 65535 cc | Not used |
| 2-4 | reserved | | | | |
| 5 | Pump1 flow | A | 3 bytes | 0 to 838860,8 L/h<br>0 to 13981,01 L/min | |
| 6 | Pump2 flow | A | 3 bytes | 0 to 838860,8 L/h<br>0 to 1981,01 L/min | Not used |
| 7-9 | reserved | | | | |
| 10 | Pump1 speed | D | 2 bytes | 0 to 8191,87 rpm | |
| 11 | Pump2 speed | D | 2 bytes | 0 to 8191, 87 rpm | Not used |
| 12-14 | reserved | | | | |
| 15-19 | reserved | | | | |
| 20 | Driver command | B | 1 byte | -100 to 100 % | |
| 21-24 | reserved | | | | |
| 25 | Brake command | B | 1 byte | -100 to 100 % | |
| 26-29 | reserved | | | | |
| 30 | Inching command | B | 1 byte | -100 to 100 % | |
| 31-34 | reserved | | | | |
| 35-39 | reserved | | | | |
| 40 | High pressure A | C | 2 bytes | 0 to 1 048 560 kPa<br>0 to 10 485,6 bar | |
| 41 | High pressure B | C | 2 bytes | 0 to 1 048 560 kPa<br>0 to 10 485,6 bar | |
| 42-49 | reserved | | | | |
| 50 | Machine speed measured | | 2 bytes | 0 to 255,99 km/h | Not used |
| 51 | Machine speed flow | G | 2 bytes | 0 to 255,99 km/h | |
| 52-59 | reserved | | | | |
| 60 | Mode | J | 4 bits | **Transmission:**<br>0 = Neutral<br>1 = Work mode<br>2 = Road mode<br>**Assist:**<br>0 = Freewheel<br>1 = Assist<br>2 = Creep<br>**CDM:**<br>0 = Freewheel<br>1 = Creep | Not used |
| 61 | Actual gear | E | 4 bits | 0 = Undefined<br>1 = Gear 1<br>2 = Gear 2<br>...<br>15 = Gear 15 | Not used |
| 62 | Direction F/N/R | I | 2 bits | 0 = Neutral<br>1 = Forward<br>2 = Reverse<br>3 = Not available | |
| 63 | Limp mode code | K | 1 byte | 0 to 255 | Not used |
| 64 | Limp mode activation | I | 2 bits | 0 = Not Active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| 65 | Power level 1 | F | 2 bytes | 0 to 32 767,5 kW | |
| 66 | Power level 2 | F | 2 bytes | 0 to 32 767,5 kW | |
| 67-69 | reserved | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 70 | Power limitation 1 activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 71 | Power limitation 2 activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 72-74 | reserved | | | | |
| 75 | Pressure limiter 1 activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 76 | Pressure limiter 2 activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 77-79 | reserved | | | | |
| 80 | Torque limitation 1 activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| 81 | Torque limitation 2 activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| 82-84 | reserved | | | | |
| 85 | Antistall activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 86 | Engine overspeed activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 87 | Speed loop activated | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 88 | Temperature security status | I | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| 89 | reserved | | | | |
| 90 | Active error codes every n seconds the SmartDrive will shift this value to the next active error code | K | 1 byte | 0 = No error<br>1-255 = Active Error code | |
| 91 | PDU1 Format frame command | | 1 byte | 1 = cf message PHR_1 | |

**PGN definitions**

| Name | Identifier (Hex) | Byte | Bit | Comment/ Parameter | PH SPN | Length of resolution | Operating data range | Notes |
|---|---|---|---|---|---|---|---|---|
| PH_1 | 18 FF 80 xx (P=6 PGN = 65408 SA = xxh) | 1-2 | | Pump1 Command | 0 | 1 cc/bit | 0 to 65 535 cc | |
| | | 3-5 | | Pump1 flow | 5 | 0.05 L/h per bit | 0 to 838 860,8 L/h | |
| | | 6-7 | | Pump1 speed | 10 | 0.125 rpm/bit | 0 to 8 191,87 rpm | |
| | | 8 | | Not used | | | 0xFF | |
| PH_2 | 18 FF 81 xx (P=6 PGN = 65409 SA = xxh) | 1-2 | | Pump2 Command | 1 | 1 cc/bit | 0 to 65 535 cc | Not used |
| | | 3-5 | | Pump2 flow | 6 | 0.05 L/h per bit | 0 to 838 860,8 L/h | Not used |
| | | 6-7 | | Pump2 speed | 11 | 0.125 rpm/bit | 0 to 8 191,87 rpm | Not used |
| | | 8 | | Not used | | | 0xFF | |

| Name | Identifier (Hex) | Byte | Bit | Comment/ Parameter | PH SPN | Length of resolution | Operating data range | Notes |
|---|---|---|---|---|---|---|---|---|
| PH_3 | 18 FF 82 xx (P=6 PGN = 65410 SA = xxh) | 1 | | Driver command | 20 | 0.8 %/bit offset: -100% | -100 to 100% | |
| | | 2 | | Brake command | 25 | 0.8 %/bit offset: -100% | -100 to 100% | |
| | | 3 | | Inching command | 30 | 0.8 %/bit offset: -100% | -100 to 100% | Not used |
| | | 4 | 1-2 | Power limitation 1 activated | 70 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | | 3-4 | Power limitation 2 activated | 71 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | | 5-6 | Pressure limitation 1 activated | 75 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | | 7-8 | Pressure limitation 2 activated | 76 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | 5 | 1-2 | Torque limitation 1 activated | 80 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| | | | 3-4 | Torque limitation 2 activated | 81 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| | | | 5-6 | Antistall activated | 85 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| | | | 7-8 | Engine overspeed activated | 86 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | 6 | 1-2 | Speed loop activated | 87 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | | 3-4 | Temperature security status | 88 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | |
| | | | 5-6 | Not used | | 2 bits | 11b | |
| | | | 7-8 | Not used | | 2 bits | 11b | |
| | | 7 | | Active error codes | 90 | 1 byte | 0 = No error<br>1-255 = active error code | |
| | | 8 | | Not used | | | 0xFF | |

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | PH SPN | Length of resolution | Operating data range | Notes |
|---|---|---|---|---|---|---|---|---|
| PH_4 | 18 FF 83 xx (P=6 PGN = 65411 SA = xxh) | 1-2 | | Machine speed measured | 50 | 1/256 km/h per bit | 0 to 255,99 km/h | Not used |
| | | 3-4 | | Machine speed flow | 51 | 1/256 km/h per bit | 0 to 255,99 km/h | |
| | | 5 | 1-4 | Mode | 60 | 4 bits | **Transmission:**<br>0 = Neutral<br>1 = Work mode<br>2 = Road mode<br>**Assist:**<br>0 = Freewheel<br>1 = Assist<br>2 = Creep<br>**CDM:**<br>0 = Freewheel<br>1 = Creep | Not used |
| | | | 5-8 | Actual gear | 61 | 4 bits | 0 = Undefined<br>1 = Gear 1<br>2 = Gear 2<br>...<br>15 = Gear 15 | Not used |
| | | 6 | 1-2 | Direction (F/N/R) | 62 | 2 bits | 0 = Neutral<br>1 = Forward<br>2 = Reverse<br>3 = Not available | |
| | | | 3-4 | Limp mode activated | 64 | 2 bits | 0 = Not active<br>1 = Active<br>2 = Not defined<br>3 = Not available | Not used |
| | | | 5-8 | Not used | | 4 bits | 1111b | |
| | | 7 | | Limp mode code | 63 | 8 bits | 0 to 255 | Not used |
| | | 8 | | Not used | | | 0xFF | |
| PH_5 | 18 FF 84 xx (P=6 PGN = 65412 SA = xxh) | 1-2 | | High pressure A | 40 | 16 kPa/bit | 0 to 1 048 560 kPa<br>0 to 10 485,6 bar | |
| | | 3-4 | | High pressure B | 41 | 16 kPa/bit | 0 to 1 048 560 kPa<br>0 to 10 485,6 bar | |
| | | 5-6 | | Power level 1 | 65 | 0.5 kW/bit | 0 to 32 767,5 kW | |
| | | 7-8 | | Power level 2 | 66 | 0.5 kW/bit | 0 to 32 767,5 kW | |

## Braking/Inching management

### Aim of the function

• Provide hydrostatic braking according to driver request (braking function).

• Provide inching, reduced machine speed, according to driver request (inching function).

### Description

• Braking: PWe ECU manages hydrostatic braking (m/s²) proportionally to braking/inching pedal position.

• Inching: PWe ECU manages requested machine speed thanks to: *command device position x (1 – braking/inching pedal position).*

First part of pedal range is used for inching and second part for braking. Pedal position to switch from inching to braking is adjustable by parameter.

### Ergonomics

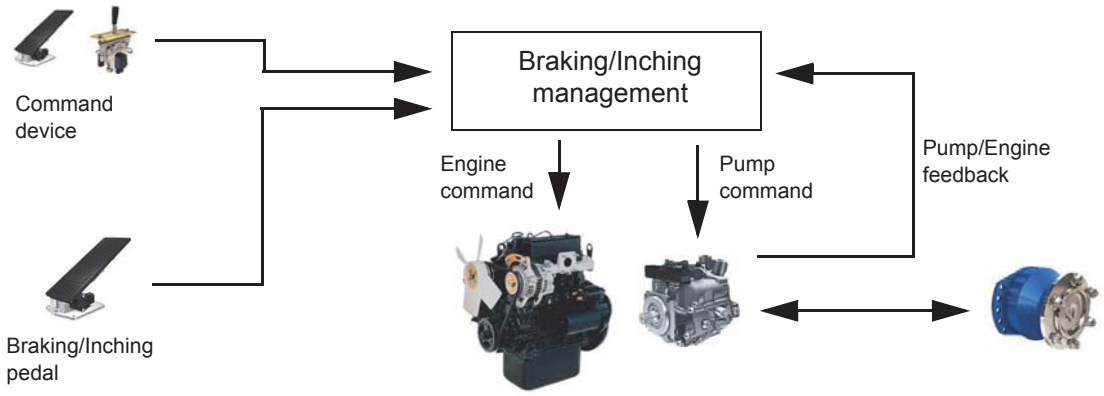
• When using braking, machine decelerates until stop. When releasing braking/inching pedal before machine stop, the driver will first have to bring the joystick or travel pedal back to the position matching the current vehicle speed to recover the full control of the speed.

• When using inching, machine speed is reduced according to braking/inching pedal position, following standard deceleration ramp. When inching is released, machine recovers original speed following standard acceleration ramp.

### Inputs/Outputs

• 1 analog input or 2 analog inputs (for redundancy) to read braking/inching pedal position.

• CAN bus for 1 frequency input for pump speed sensor.



## Speed control loop

### Aim of the function

Provide constant machine speed whatever the engine speed.

### Description

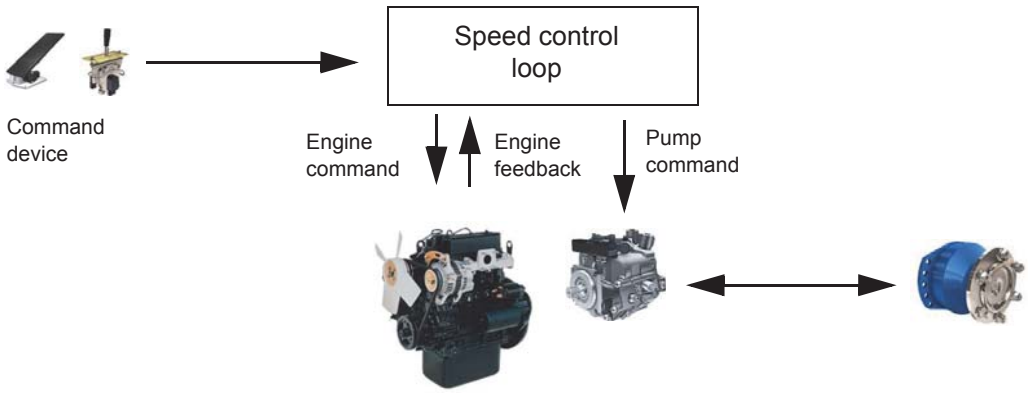
PWe ECU monitors engine speed and adjusts pump displacement to keep constant machine spped (according to command device position).

### Ergonomics

Driver must use display to activate the function. If not activated, engine speed can change machine speed.

### Inputs/Outputs

- CAN bus or 1 frequency input for reading the speed of engine/pump.
- CAN bus for display.
- Command device: joystick or pedal.



## CAN slave management

**Usage sum up**

CAN communication used by CAN slave is matching J1939 communication rules and frame definition. Used PGN are defined within customer specific ID range.

To command the pump, following data are required:

- Pump direction (Neutral, direction A or direction B)
- Pump enable (Active or not)
- Pump command (in cc, with ramp management following parameter)

To improve safety of the command sent to the PWe pump throughout CAN bus, there is a counter that should be incremented each time a new can frame is transmitted. This counter is 8bits long and is free running. It will return to 0 after 255. A second message will be sent as redundancy purpose, it will contain one complemented data from main command frame. PWe ECU will check consistency between main and redundancy CAN frame. In case of recurrent discrepancy PWe pump will enter in safe mode and bring pump back to neutral.

Conditions of CAN communication that can stop the pump:

- If main or redundant messages are missing for 0.5s, pump will go back to neutral following a specific ramp (1.5s).
- If main and redundant messages are inconsistent 3 times (consecutively) pump will go back to neutral following a specific ramp (1.5s).
- If counter of main message isn't increasing, pump will go back to neutral following a specific ramp (1.5s).

To ensure that redundant message will not be received before main message, redundant message will be sent at least 10ms after main message.

After pump start-up an initial condition must be observed regarding the pump command to be able to stroke the pump. This initial condition must be:

- Pump command = 0cc
- Pump enable = FALSE
- Pump direction = Neutral

To inform master PWe ECU of transmission condition pump will send CAN frames containing pressure, speed, temperature information. Those information will be transmitted in two ways:

- Physical values, computed using parameters value defining sensor characteristics.
- Electrical values that are direct RAW reading. Master PWe ECU will have to compute by its own physical values based on its own parameters. Master PWe ECU will also have to take care of signal range validity to detect sensor disconnection

.

**Parametres dedicated to CAN slave communication**

| | |
|---|---|
| **Name** | Rate of PHPI messages |
| **Description** | Define the transmission period for PHPIx messages. |
| **Min. value** | 0,01s |
| **Max. value** | 0,20s |

| | |
|---|---|
| **Name** | Rate of PHPC messages and pump control tasks. |
| **Description** | Define the typical period for PHPCx messages. |
| **Min. value** | 0,01s |
| **Max. value** | 0,10s |

| | |
|---|---|
| **Name** | Ramp of deceleration in case of fault.. |
| **Description** | Define the ramp used to bring the pump back to neutral when CAN communication is lost with master PWe ECU. This parameter defines time in s taken to bring the pump from full displacement to neutral. (I.e. if the pump was stroked to half displacement when the fault occurred, it will take half the specified time to get back to neutral). |
| **Min. value** | 0,5s |
| **Max. value** | 6553,4s |

| | |
|---|---|
| **Name** | Wait for 1st valid command after powerUP. |
| **Description** | Define the initial time allowed after PWe pump power up to start communication with master PWe ECU. This is intended to let time to master PWe ECU to boot up and start CAN communication without triggering errors. |
| **Min. value** | 0,1s |
| **Max. value** | 30s |

| Name | Own J1939 address in Slave |
|---|---|
| Description | J1939 address of PWe ECU |
| Min. value | 0 |
| Max. value | 255 |

| Name | J1939 address of commander |
|---|---|
| Description | J1939 address of master PWe ECU |
| Min. value | 0 |
| Max. value | 255 |

## Details of CAN messages

**INPUTS (Master to PWe pump):**

POCLAIN HYDRAULICS PUMP COMMAND#1 (PHPC1) - PGN 61184
*(Transmission rate: 10 - 100ms):*

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | SPN | Length or resolution | Operating data range |
|---|---|---|---|---|---|---|---|
| PHPC1 | 18 EF yy xx (P=6 PGN=61184 DA = yyh SA = xxh) | 1 | | Data index | | 1 byte | 01h = pump command |
| | | 2 | 1-2 | Pump direction | | 2 bits | 00b = Neutral<br>01b = Direction A<br>10b = Direction B<br>11b = Not defined (Neutral) |
| | | | 3-4 | Pump enable | | 2 bits | 00b = Not activated<br>01b = Activated<br>10b = Not defined (Not activated)<br>11b = Not defined (Not activated) |
| | | | 5-8 | Not used | N/A | | 1111b |
| | | 3-4 | | Pump command | | 2 bytes $1/10^{th}$ cc | 0.0 to 6553.4 cc |
| | | 5-6 | | Not used | | 2 bytes | FFFFh |
| | | 7 | | Not used | | 1 byte | FFh |
| | | 8 | | Command message counter | | 1 byte | 0 to 255 |

**In the following message, the ~ means Complement to 1.**
**For example: ~ PHPC1.byte8 =0xFF - PHPC1.byte8.**

POCLAIN HYDRAULICS PUMP COMMAND#2 (PHPC2) - PGN 61184
*(Transmission rate: 10 - 100ms):*

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | SPN | Length or resolution | Operating data range |
|---|---|---|---|---|---|---|---|
| PHPC2 | 18 EF yy xx (P6=6 PGN= 61184 DA = yyh SA = xxh) | 1 | | Data index | | 1 byte | 02h = pump command redundancy |
| | | 2 | | Data index | | 1 byte | = ~PHPC1.byte8 |
| | | 3 | | Redundant signal | | 1 byte | = ~PHPC1.byte7 |
| | | 4 | | Redundant signal | | 1 byte | = ~PHPC1.byte6 |
| | | 5 | | Redundant signal | | 1 byte | = ~PHPC1.byte5 |
| | | 6 | | Redundant signal | | 1 byte | = ~PHPC1.byte4 |
| | | 7 | | Redundant signal | | 1 byte | = ~PHPC1.byte3 |
| | | 8 | | Redundant signal | | 1 byte | = ~PHPC1.byte2 |

- For those messages DA value comes from “Own J1939 address in Slave” parameter.
- For those messages SA value comes from “J1939 address of commander” parameter.

**Care must be taken to compute PHPC2 message using the same input values than PHPC1.**

**Example of CAN messages:**

**Pump commanded in direction A:**

| | | | | | |
|---|---|---|---|---|---|
| 0.005004 | 18EF1FEx | PHPC1 | Tx | 8 | 01 F5 00 00 FF FF FF A1 |
| 0.005048 | 18EF1FEx | PHPC2 | Tx | 8 | 02 5E 00 00 FF FF FF 0A |

**Pump commanded in direction A @2.1cc:**

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.005108 | 18EF1FEx | PHPC1 | Tx | 8 | 01 F5 15 00 FF FF FF E3 |
| 0.005401 | 18EF1FEx | PHPC2 | Tx | 8 | 02 1C 00 00 00 FF EA 0A |

**Pump commanded in direction A @3.2cc:**

| | | | | | |
|---|---|---|---|---|---|
| 0.006000 | 18EF1FEx | PHPC1 | Tx | 8 | 01 F6 20 00 FF FF FF 2D |
| 0.004028 | 18EF1FEx | PHPC2 | Tx | 8 | 02 D2 00 00 00 FF DF 09 |

**OUTPUTS (PWe pump to master):**

POCLAIN HYDRAULICS PUMP INFO#1 (PHPI1) - PGN 65386
*(Transmission rate: 10 - 100ms [parameter, 100ms by default]):*

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | SPN | Length or resolution | Operating data range |
|---|---|---|---|---|---|---|---|
| PHPI1 | 18 FF6Axx (P=6 PGN=65386 SA = xxh) | 1-2 | | Pump displacement | | 2 bytes 1/10$^{th}$ cc | 0.00 to 6553.4 cc FFFFh = N/A |
| | | 3-4 | | Pump feedback voltage | | 2 bytes mV | 0000 to 5200 mV FFFFh = N/A |
| | | 5-6 | | Drift voltage | | 2 bytes mV | -5200 to 5200 mV<br>offset: RAW = mV + 5200 FFFFh = N/A |
| | | 7 | 1 | Pump enabled<br>*isPumpOk() & pumpEnable_received* | | bool | 0b = Pump disabled<br>1b = Pump enabled |
| | | | 2 | S1 connection error | | bool | 0b = Cnx OK<br>1b = Cnx fault |
| | | | 3 | S2 connection error | | bool | 0b = Cnx OK<br>1b = Cnx fault |
| | | | 4 | Cut-off connection error | | bool | 0b = Cnx OK<br>1b = Cnx fault |
| | | | 5 | By-pass connection error | | bool | 0b = Cnx OK<br>1b = Cnx fault |
| | | | 6 | Loop error | | bool | 0b = Error not active<br>1b = Error active |
| | | | 7 | Drift error | | bool | 0b = Error not active<br>1b = Error active |
| | | | 8 | FB error | | bool | 0b = Error not active<br>1b = Error active |
| | | 8 | 1 | Pollution | | bool | 0b = No pollution<br>1b = Pollution |
| | | | 2 | General safe state | | bool | 0b = NoGSS<br>1b = GSS |
| | | | 3-4 | Pump direction | | 2 bits | 00b = Neutral<br>01b = Direction A<br>10b = Direction B<br>11b = Not defined (Neutral) |
| | | | 5 | Initial frame received | N/A | | 0b = Frame not received<br>1b = Frame was received |
| | | | 6 | Communication error flag | N/A | | 0b = Error not active<br>1b = Error active |
| | | | 7 | Not used | N/A | | 1b |
| | | | 8 | Not used | N/A | | 1b |

POCLAIN HYDRAULICS PUMP INFO#2 (PHPI2) - PGN 65387
*(Transmission rate: 10 - 100ms [parameter, 100ms by default]):*

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | SPN | Length or resolution | Operating data range |
|---|---|---|---|---|---|---|---|
| PHPI2 | 18 FF6Bxx (P=6 PGN = 65387 SA = xxh) | 1-2 | | Power supply voltage | | 2 bytes 1mV/bit | 0000 to32000 mV<br>FFFFh = N/A |
| | | 3-4 | | 5V supply output | | 2 bytes 1 mV/bit | 000000 to 5500 mV<br>FFFFh = N/A |
| | | 5-6 | | Max. pump displacement | | 2 bytes 1/10$^{th}$ cc | 0.0 to 6553.4 cc<br>FFFFh = N/A |
| | | 7-8 | | Not used | | 2 bytes | FFFFh |

• For those messages SA value comes from “Own J1939 address in Slave” parameter.

**Other available outputs:**

The pump can be equipped of sensors (temperature, pressure and speed). Their value will be send on the CAN bus.
2 types of information on the CAN bus:
• Physical value (in V or Hz)
• Calculated value (in bars or RPM or °C)
If the sensor voltage is out of valid range (0.5V – 4.5V), calculated value will be FFFFh. There is no management for sensors.
With Phases we have possibility to modify sensor's parameter for pressure and temperature sensors (Bar/Volt, Degree/Volt,...).

POCLAIN HYDRAULICS PUMP INFO#3 (PHPI3) - PGN 65388
*(Transmission rate: 10 - 100ms [parameter, 100ms by default]):*

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | SPN | Length or resolution | Operating data range |
|---|---|---|---|---|---|---|---|
| PHPI3 | 18 FF6Cxx (P=6 PGN=65388 SA = xxh) | 1-2 | | HPA pressure sensor voltage | | 2 bytes 1mV/bit | 0000 to 5200 mV |
| | | 3-4 | | HPA pressure sensor | | 2 bytes 16kPa/bit | 000000 to 100000 kPa<br>FFFFh = signal not present |
| | | 5-6 | | HPB pressure sensor voltage | | 2 bytes 1mV/bit | 0000 to5200 mV |
| | | 7-8 | | HPB pressure sensor | | 2 bytes 16kPa/bit | 000000 to 100000 kPa<br>FFFFh = signal not present |

POCLAIN HYDRAULICS PUMP INFO#4 (PHPI4) - PGN 65389
*(Transmission rate: 10 - 100ms [parameter, 100ms by default]):*

| Name | Identifier (Hex) | Byte | Bit | Comment/Parameter | SPN | Length or resolution | Operating data range |
|---|---|---|---|---|---|---|---|
| PHPI4 | 18 FF6Dxx (P=6 PGN=65389 SA = xxh) | 1-2 | | Speed sensor frequency | | 2 bytes 0,15 Hz/bit | 0000 to 8500 Hz |
| | | 3-4 | | Speed sensor | | 2 bytes 0,125 RPM/bit | 0000 to 5000 RPM |
| | | 5-6 | | Temperature sensor voltage | | 2 bytes 1mV/bit | 0000 to 5000 mV<br>FFFFh = signal not present |
| | | 7 | | Temperature sensor | | 1 byte 1°C/bit | -40°C to +210°C<br>offset: RAW = °C + 40<br>FFFFh = signal not present |
| | | 8 | | Not used | | 1 byte | FFh |

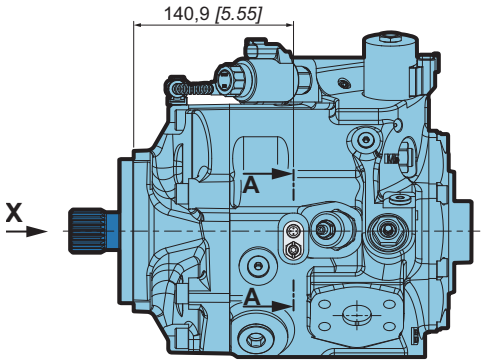
• For those messages SA value comes from "Own J1939 address in Slave" parameter.

# OPTIONS

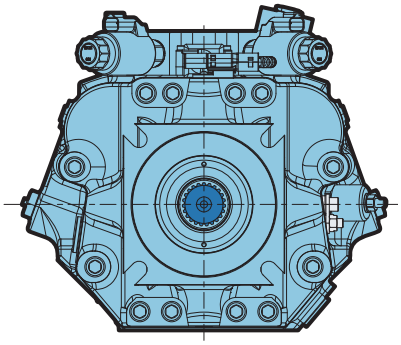
## Installed speed sensor or predisposition

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PW / PWe | 085 / 096 | D | M | C | O | H1 | H2 | G | L | A | F | S | | | | | P | C | E | B |

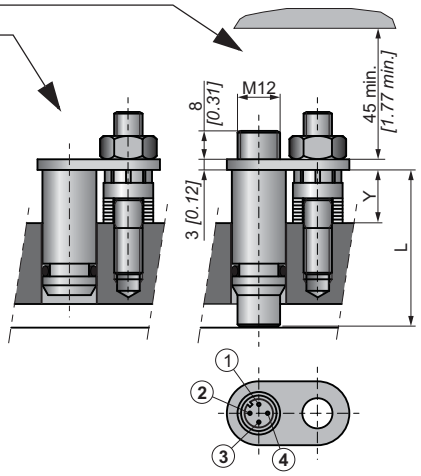
T4 speed sensor (without rotation direction) — 2
Predisposition for speed sensor — 8




"X"



A-A




Max. length Y = 15,2 [0.60]
Standard number of pulses per revolution = 9

**To install the sensor, see the "Installation guide" brochure No. 801478197L.**

### T4 speed sensor specification

| Commercial name | T4 SENSOR 12-44 |
|---|---|
| Part number | A22082C |
| Lenght L | 44 [1.73] |
| Function | Detect movements : rotation speed |
| Compatibility | Electronic transmission management |

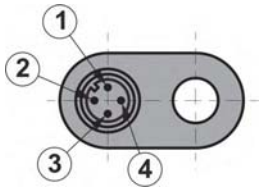
## Installed speed sensor or predisposition

| Features | |
|---|---|
| Supply voltage | 8 - 30 V |
| Output type | - 1 push-pull square frequency signal<br>- Maximum load current: 20 mA<br>- Voltage at low state: < 1.5 V<br>- Voltage at high state: > (power supply voltage - 3.5 V) |
| Maximum range | 1.15 mm *[0.045"]* |
| Current consumption | 20 mA max. |
| Frequency range | 0 to 15 kHz |
| Operating temperature | - 40°C to + 125°C *[- 40°F to 257°F]* |
| Material | Stainless steel |
| Protection rating | IP68 (sensitive side) / IP67 (connector side) |
| Electrical protection | Reverse polarity |

**Signals are not protected against short circuit to ground or supply.**

### Connection of the speed sensor

Remove the plastic plug on the connector.




| Function | Pin number |
|---|---|
| Power supply | 1 |
| Not present | 2 |
| Ground | 3 |
| Square frequency signal | 4 |

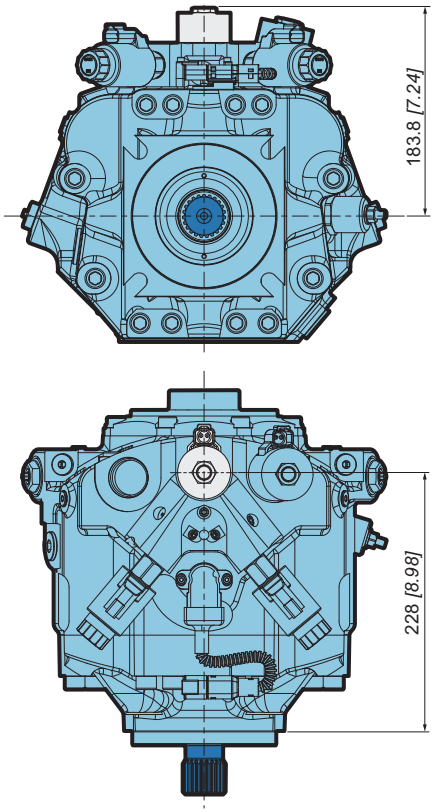
For the connection of connectors, please refer to the connection table and the general cabling plan contained in the installation brochure for your transmission.

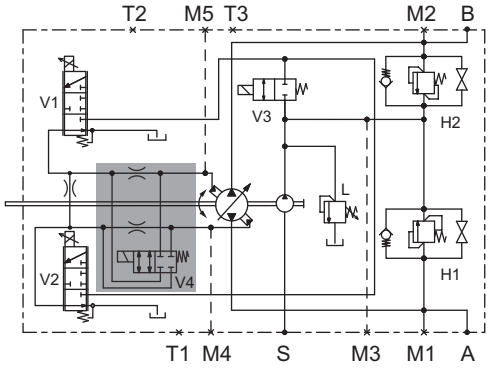
| Electrical connections | 90° | 180° |
|---|---|---|
| Commercial name | ELEC-CABLE-M12-90°-5000 | ELEC-CABLE-M12-180°-5000 |
| Part number | A04999J | A07468S |

## By-pass of orifices in SA control


| Ports mm *[inch]* | | | | |
|---|---|---|---|---|
| (P) inlet | (S1) servo | (S2) servo | (T) | |
| 0,8 *[0.031]* | 0,8 *[0.031]* | 0,8 *[0.031]* | N/A | **1** |
| w/o | 1,5 *[0.059]* | 1,5 *[0.059]* | N/A | **2** |
| w/o | 0,8 *[0.031]* | 0,8 *[0.031]* | N/A | **3** |

- Pump control optional function.
- Ensures fast pump response in normal working modes and in the same time ensures slow (safe) pump return to neutral position when it´s required or in case of electronic failure.
- Size of orifices has to be defined based on the application.



## Special paint or no paint

| PW085 / PWe096 | M | C | O | H1 | H2 | G | L | A | F | S | P | C | E | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | D | | | | |

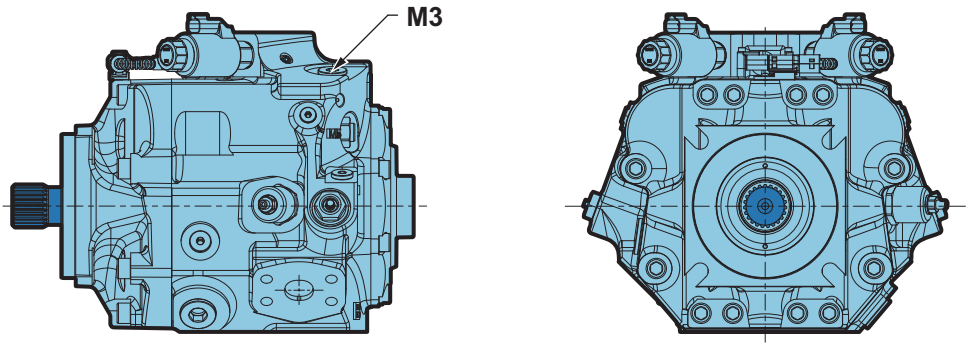
The pumps are delivered with Poclain Hydraulics black primer (RAL 9005) as standard.

**Consult your Poclain Hydraulics application engineer for other colors of primer or topcoat.**

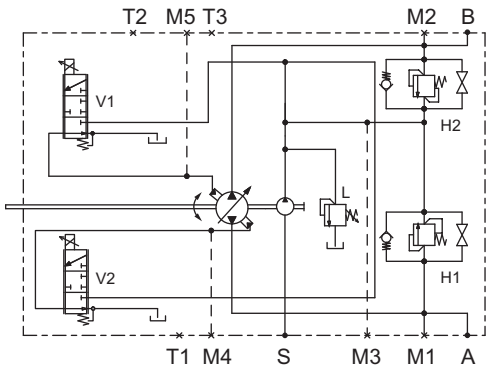
## Without control pressure cut-off valve

| PW085 / PWe096 | M | C | O | H1 | H2 | G | L | A | F | S | P | C | E | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | C | | | | |

Control pressure cut-off valve is not mandatory for some specific applications where the pump is not used as main drive (e.g. assist drive).




| Port | Function | Size | Norm |
|---|---|---|---|
| M3 | Charge pressure | 7/8-14 UNF-2B | ISO 11926-1 |

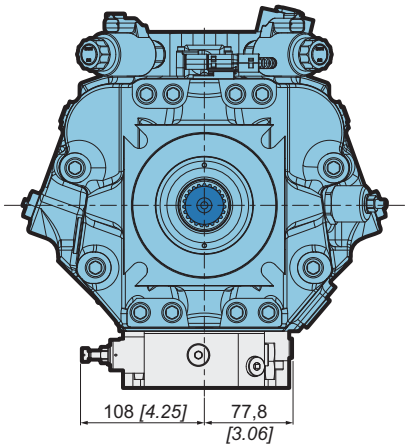


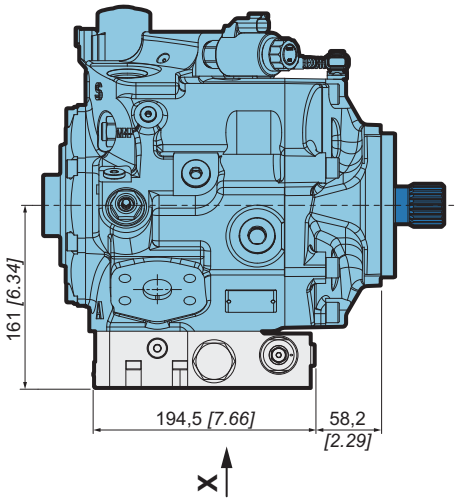
## Exchange valve

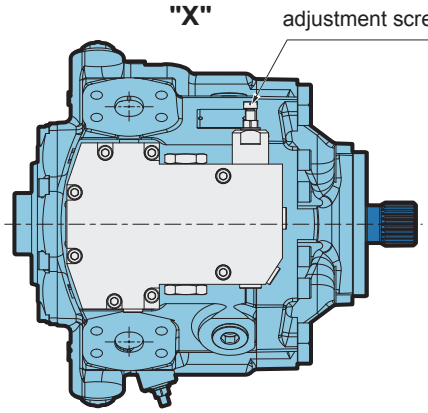
| PW | 085 |
|---|---|
| PWe | 096 |

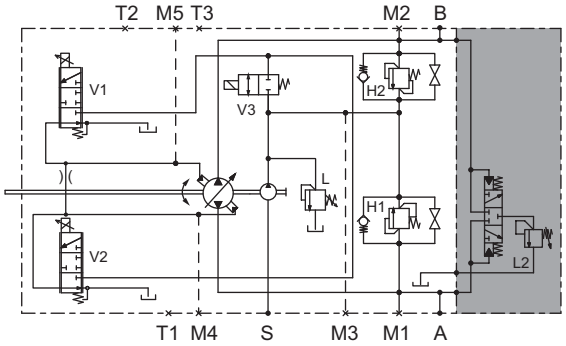
| M | C | O | H1 | H2 | G | L | A | F | S | P | C | E | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | H | | | | |

Inside the pump cover, a purge valve can be fitted with discharge inside the pump casing by means of a calibrated hole. The exchange valve is useful in case the temperature of the oil in the closed circuit is too high.



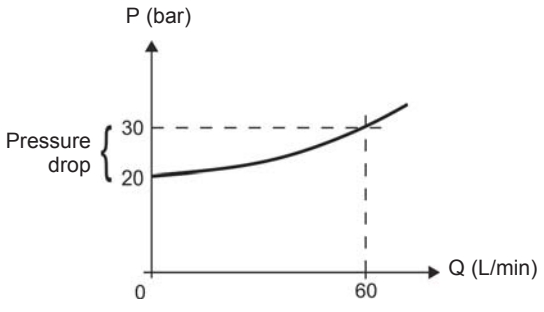




**Setting of exchange valve should be approximately 3~5 bar *[44~73 PSI]* lower than for charge relief valve (see chapter "Charge pressure relief valve", page 20). Consult with your Poclain Hydraulics application engineer for precise setting.**

| Specification | |
|---|---|
| Exchange valve adjustment range | 18 to 30 bar *[261 to 435 PSI]* |
| Exchange flow (10 bar *[145 PSI]* ΔP) | 60 L/min *[15.85 gal/min]* |
| Exchange direction | Forward and/or reverse |

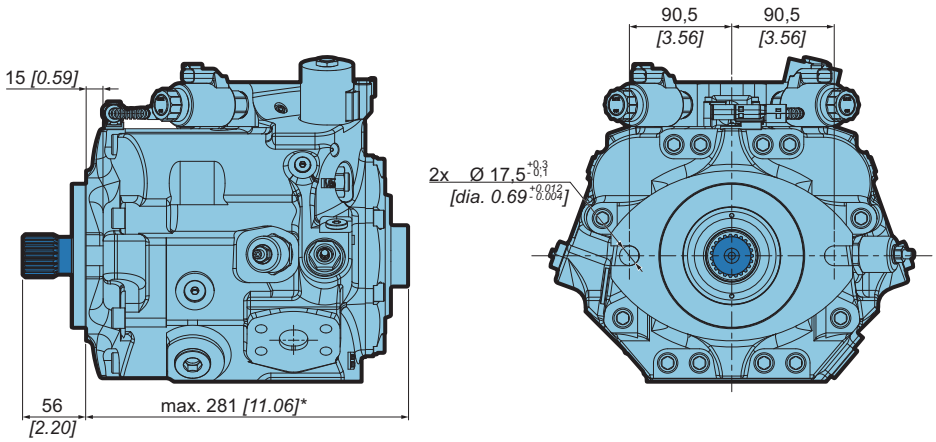
Example: relief valve set at 20 bar



## 2-bolt bearing flange mounting&

PW 085
PWe 096

M C O H1 H2 G L A F S P C E B
M




All length dimensions of pump body with different auxiliary mounting pads are shorter compare to standard 4-bolt flange of 14 mm *[0.55 inch]*.

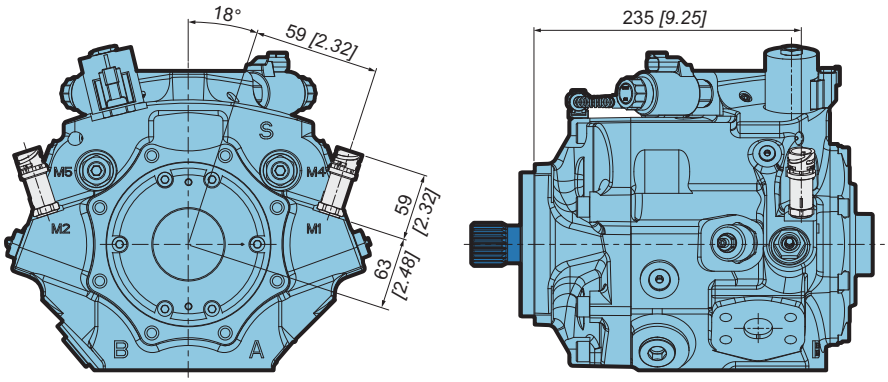
**Bearing life and maximum overhung moment is significantly lower compare to 4 bolt flange, see page 16 for Bearing life ($B_{10}$ hours) and page 17 for allowable moment values.**

## Pressure sensors on A&B lines

PW 085
PWe 096

M C O H1 H2 G L A F S P C E B
R

The pump can be equipped with 600 bar *[8702 PSI]* pressure sensors.

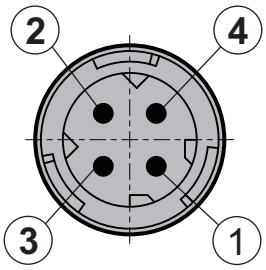



### Pressure sensor specification

| Commercial name | PRES-SENSOR-600B-G1/4-DIN |
|---|---|
| Part number | A53472W |
| Compatibility | Electronic transmission management |

## Pressure sensors on A&B lines

| Features | |
|---|---|
| Supply voltage | 5 V ± 0,5 V |
| Output signal | 0,5 V ~ 4,5 V ratiometric |
| Pressure range | 600 bar *[8702 PSI]* |
| Over pressure safety | 1200 bar *[17404 PSI]* |
| Pressure connection with VITON rectangular seal | G 1/4" (DIN 3852-E) |
| Response time | < 5 ms |
| Accuracy | < 1% |
| Using temperature range | Medium - 40 °C to 125 °C *[- 40 °F to 257 °F]* |
| | Ambient - 40 °C to 100 °C *[- 40 °F to 212 °F]* |
| | Storage - 40 °C to 120 °C *[- 40 °F to 248 °F]* |
| Ingress protection | IP69K (IEC 60529) |
| CE conformity | EN 61326 |
| Overvoltage and reverse polarity protection | ± 30 V |
| Shock resistance | 500 g according to DIN EN 837 |
| Vibration resistance | 20 g according to IEC 68-2 |
| **Electrical connection** | DIN 72585, 4 pins |



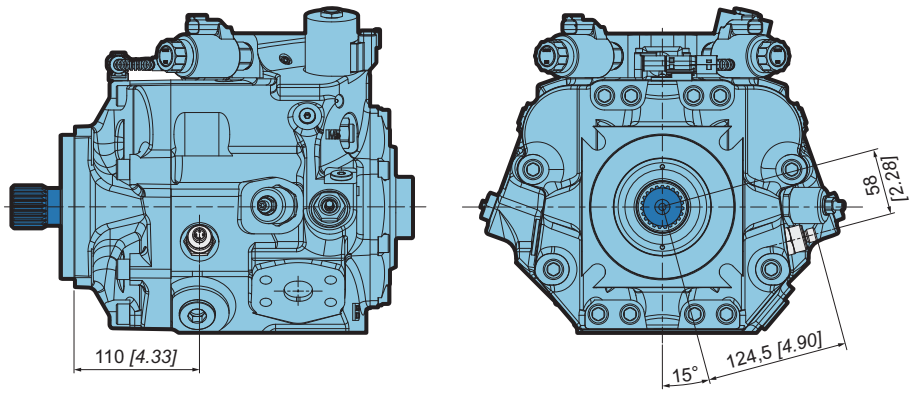

1: +5 VDC
2: Ground
3: Output signal
4: Not used

## Temperature sensor

PW 085
PWe 096

M C O H1 H2 G L A F S P C E B
T

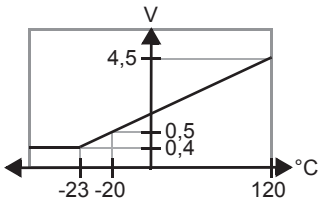
The pump can be equipped with analog temperature sensor.



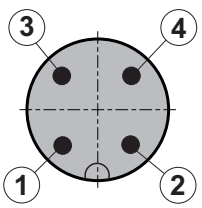

### Temperature sensor specification

| Commercial name | TEMP-SENSOR-ANALOG-G1/4-M12 |
|---|---|
| Part number | A22147X |
| Compatibility | Electronic transmission management |
| Fonction | Measure the temperature of the hydraulic circuit |

| Features | |
|---|---|
| Power supply | 5V ± 0.5 V |
| Output signal | 0.5 V to 4.5 V radiometric<br>Saturation at 0.4 V for temperatures < -23°C *[-9.4°F]* |
| Response time | 5 s |
| Accuracy | ±1.5% FS from -20°C *[-4°F]* to 0°C *[32°F]*<br>±1% FS from 0°C *[32°F]* to 120°C *[248°F]* |
| Permissible pressure | 750 bar *[10 877 PSI]* |
| Using temperature range | -20 to +120°C *[-4 to +248°F]* |
| Housing material | Inox 304 |
| Ingress protection | IP67 |
| Electrical protection | - Over voltage: 30 V<br>- Reverse polarity,<br>- Short circuit. |
| Shock resistance | 1m 3 axes |
| Vibration resistance | 20 g |




| Electrical connection | 90° | 180° |
|---|---|---|
| Commercial name | ELEC-CABLE-M12-90°-5000 | ELEC-CABLE-M12-180°-5000 |
| Part No. | A04999J | A07468S |




1: nc
2:+5 V
3: Output signal 0,5 ~ 4,5 V
4: 0 V (Ground)

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