

SMARTDRIVE EASY SYSTEM

HYDROSTATIC TRANSMISSION



T E C H N I C A L C A T A L O G



Methodology :

This document is intended for manufacturers of machines that incorporate Poclain Hydraulics products. It describes the technical characteristics of Poclain Hydraulics products and specifies installation conditions that will ensure optimum operation. This document includes important comments concerning safety. They are indicated in the following way:



Safety comment.

This document also includes essential operating instructions for the product and general information. These are indicated in the following way:



Essential instructions.



General information .



Information on the model number.



Weight of component without oil.



Volume of oil.



Units.



Tightening torque.



Screws.



Information intended for Poclain-Hydraulics personnel.

The views in this document are created using metric standards.
The dimensional data is given in mm and in inches (inches are given in brackets in italic)





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Characteristics

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FOREWORD

Introduction

Poclain Hydraulics has created and developed Smart Drive™ Easy, a system that simplifies and optimizes the running of hydrostatic transmissions (e.g. mobile machinery).

It includes a computer that regulates the running of the hydrostatic transmission components (engine, hydraulic pump, hydraulic motors and brakes) through sensors and actuators.

The on-board software calculates the machine's ground drive speed according to the driver setting, and the programmed acceleration and deceleration ramps. These ramps, which are among the many parameters that enable the machine's behavior to be customized, determine the vehicle's responsiveness and progressiveness.

The combination of the flexibility of the electronics and the power of the hydraulics makes this a system that can be adapted and set up for all driving styles.

Functions

Specific to each application, in general, the system offers:

- Hydrostatic transmission control;
- Automatic displacement shift;
- Management of engine rotation speed;
- Power limitation;
- Anti-stall;
- Brake management;
- Signalling,
- Speed regulation (Cruise control),
- Limp mode management.

Examples of parameters

The parameters can be set for each application, using either the PHASES software or the portable hand held terminal. They may also be subject to special access authorization.

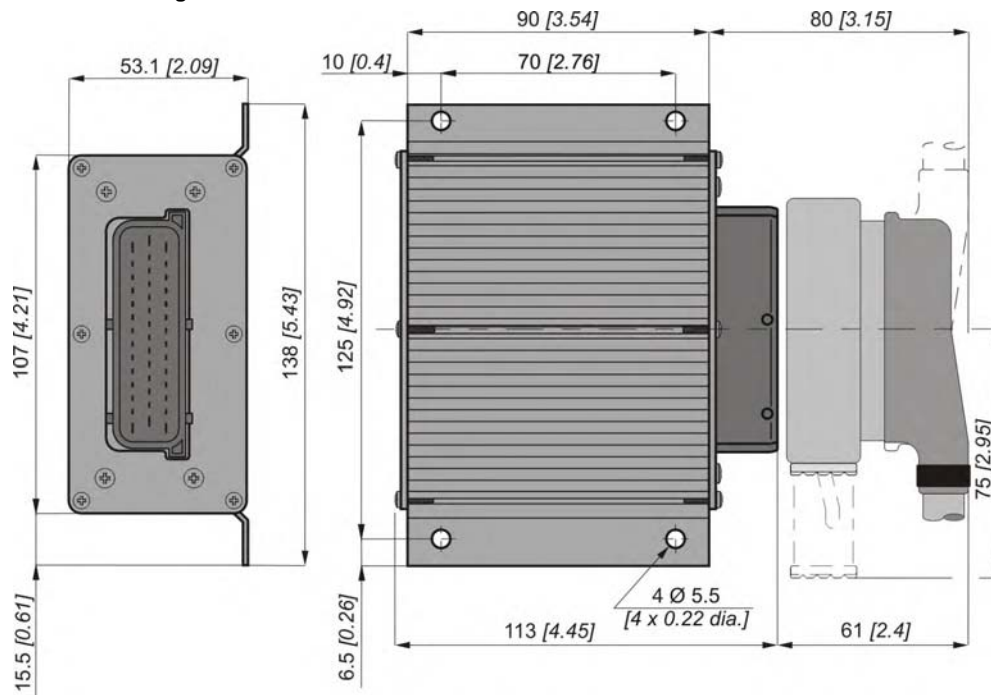
They govern:

- The pump (displacement threshold for shifting from 1st to 2nd displacement; maximum permitted displacement);
- Engine (speed, etc.);
- Hydraulic motors (displacement);
- Brake valves (dynamic brake pressure at rest);
- Sensors (emergency brake pressure detection threshold, etc.);
- Cruise control function;
- Driving modes, (automotive etc).

**Characteristics of the regulating SmartDrive Easy™ ECU**

Contact your PoclainHydraulics sales engineer for all adaptations.

Commercial name	SD-EASY-PLUS	SD-EASY-EXTENDED
Part number	B20252M	B20253N
Supply voltage	12 V DC 24 V DC	
Operating temperature	- 40°C to 85°C [-40 °F to 185°F]	
Overall dimensions	See below	
Material	Aluminum	
Mass	0.5 kg [1.1 lb]	
Mounting	4 x Ø 5.5 mm 4 x [0.22" dia.]	
ECU regulator protection index with its connectors	IP 65(weather proofing)	
Maximum current	14 A	
Electrical protection	Excess voltage, reverse polarity, short circuit	
Microprocessor	16 bits	
Microprocessor frequency	25 MHz	
Flash memory	128 KByte	256 KByte
ECU programming	Programming with a PC using the PHASES™ software application	
ECU set-up	Set-up with the software PHASES™ or the HHT	

Overall dimensions of the ECU regulator**Electromagnetic compatibility**

Electromagnetic compatibility of moving machinery is required by the European Union. Manufacturers must submit a technical summary or one of their machines to a qualified certification center.

The SmartDrive™ Easy ECU passed the electromagnetic compatibility tests for moving machinery components:

- ISO 14982: 1998
Agricultural and forestry machinery - Electromagnetic compatibility;
- EN 13 309: 2000
Construction machinery - Electromagnetic compatibility of machines with internal electrical power supply;
- EN 12895: 2000
Industrial trucks - Electromagnetic compatibility.



SmartDrive™ Easy input/output characteristics

On-Off digital inputs (x 5)

These inputs are of the ground pin type.

They are protected against short circuits on the ground, battery, 5 V and 12 V.

Description	Min.	Max.
Maximum voltage for a low level		1.65 V
Minimum voltage for a high level	3.25 V	
Allowable voltage		30 V
Maximum resistance of pin for a low level		1.5 kΩ
Minimum resistance of pin for a high level	10 kΩ	

Analog inputs (x 5)

They are protected against short circuits on the ground, battery, 5 V and 12 V.

Description	Min.	Max.
Measurement range	0 V	5 V
Accuracy		1 %
Allowable voltage		30 V
Input impedance		259 kΩ

Frequency inputs (x 2)

The sensors read can be NPN, PNP and PUSH/PULL on the two frequency inputs.

The differential sensors can only be read on the frequency input 2.

Description	Min.	Max.
Measurement range	0 Hz	8 500 Hz
Allowable voltage		30 V

Digital outputs (x 4)

They are protected against short circuits at the ground, battery, 5 V and 12 V.

These outputs are protected against thermal overload.

Description	Min.	Max.
Maximum current		0.5 A under 12V / 0.25 A under 24V
Output voltage	Vbat -1V	Vbat

Configurable PWM outputs (x 2)

• Mode 2A (pins 30, 6, 16 and 19)

These outputs are protected against short circuits on the ground, battery, 5 V and 12 V.

These outputs are protected against thermal overload.

Description	Min.	Max.
Maximum current	0	2 A under 12 V / 1 A under 24 V
Maximum frequency		3.125 kHz

• Mode 125 mA (pins 16, 20, 30 and 34)

They are protected against short circuits on the ground, battery, 5 V and 12 V.

These outputs are protected against thermal overload.

Description	Min.	Max.
Measurement range	0	125 mA
Maximum frequency		3.125 kHz

Non-configurable PWM outputs (x 2)

• Mode 2A (pins 31, 35, 17 and 21)

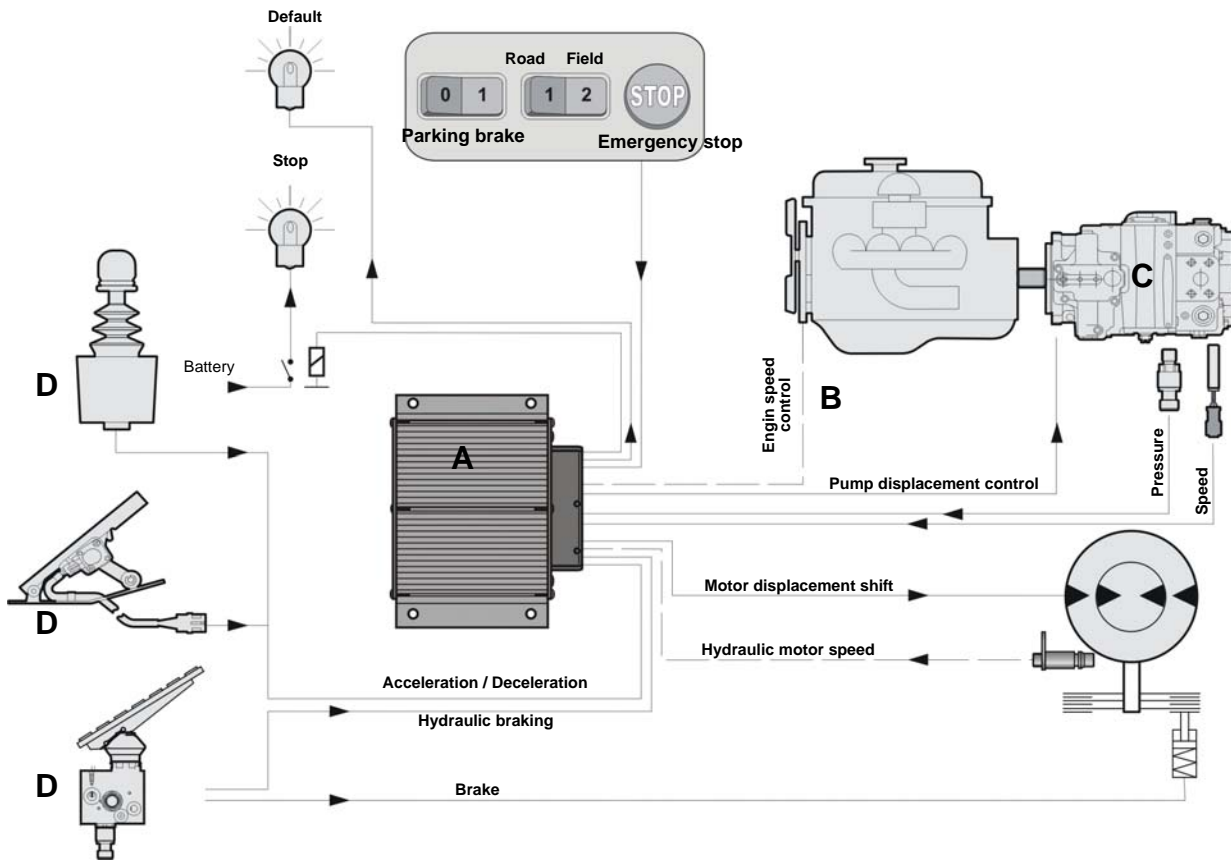
These outputs are protected against short circuits on the ground, battery, 5 V and 12 V.

These outputs are protected against thermal overload.

Description	Min.	Max.
Maximum current	0	2 A under 12 V / 1 A under 24 V
Maximum frequency		3.125 kHz



Example of hydrostatic transmission control on a vehicle.



Description :

- A - An SmartDrive™ Easy regulating ECU that controls transmission,
- B - An engine command with a CAN Bus link,
- C - A pump fitted with displacement control solenoids, a speed sensor and a 600-bar pressure sensor,
- D - A joystick or pedal, mode selection switch, default light, stop light, speed sensor display, etc.

Signalling

The ECU manages signalling (braking, reverse lights, warning beep, etc.) depending on the ground drive condition.

CAN Bus Communication

The ECU presents a standard 2.0A or the applied 2.0B CAN interface.

When connected to the machine's CAN network, the SmartDrive™ Easy ECU can therefore:

- Receive messages (joystick, selectors, reading engine rotation speed, etc.)
- Send messages (engine setting, signalling, fault indicator, error message, etc.)



CAN adjustment requires a configuration that depends on the complexity of the CAN architecture for each manufacturer. Contact your Poclain Hydraulics sales engineer.

Description of functions

Driving modes

The driver can have two standard operating configurations:

[Road Mode]

This is an **automotive** type of driving, similar to an automatic transmission. The transmission ratio is determined automatically by the load management of the engine, pump displacement and hydraulic motor displacement. The load on the engine is therefore related to the vehicle speed, resulting in the reduction of pollution and fuel consumption.



[Field Mode]

The speed of the engine is constant; the auxiliary tools consume most of its power.



It is possible to define other modes, depending on the nature of the work to be carried out and the environment. Contact your Poclairn Hydraulics sales engineer.

The ground drive parameters may thus be different from one [**Field Mode**] to another. Shifting between modes is done under different safety conditions managed by the SmartDrive™ Easy ECU.

Automatic displacement shift

The SmartDrive™ Easy transmission varies speed continually.

Depending on the acceleration or brake settings issued by the driver, hydraulic motor displacement shift is seamless. This is accomplished by simultaneous pump displacement control and motor displacement shift control.

Therefore, since the operation is practically entirely automatic, the driver can focus on tasks with higher added value, such as the machine's working functions, and, particularly, tool management.

Management of engine rotation speed

The SmartDrive™ Easy ECU can fully manage the engine via the CAN Bus.

The ECU optimizes the rotation speed of the engine for the requested power level.

Anti-stall function

This function reduces the pump displacement to prevent the engine stalling if the power required by the hydrostatic transmission exceeds the engine's available power.

Limitation of ground drive power

Some machines have engines that are oversized for the ground drive power requirement when the on-board tools are turned-off [**Field Mode**].

In [**Road Mode**], there is no protection and the engine's full power is available. Limiting the integrated power in a transmission controlled by a SmartDrive™ Easy therefore protects the hydrostatic transmission from possible excess output, which could cause irreversible damage over time.

Brake management

Service brake (dynamic)

The brake pedal:

- Activates mechanical braking,
- Reduces pump displacement via the SmartDrive™ Easy ECU.

The braking system is of the **combined type**, i.e. the mechanical braking torque combines with the hydrostatic transmission's braking torque (pump displacement reduced).

The SmartDrive™ Easy manages the pump and hydraulic motor displacement reduction by taking account of the level of mechanical braking, so that the hydrostatic transmission prevents possible wheel lock.

Brake pedal only

Adjusts the hydrostatic braking.

Parking brake

The parking brake is held by the spring force.

To deactivate this brake, the driver operates a switch, a lever or a foot control. These components then transmit pressure to the brake pistons, which cancel out the spring force.

Emergency stop



If the parking brake switch is activated for an emergency stop, the mechanical parking brakes acts and the hydrostatic brake engages by means of a pump displacement ramp managed by the SmartDrive™ Easy.

Constant speed with combined auxiliary control

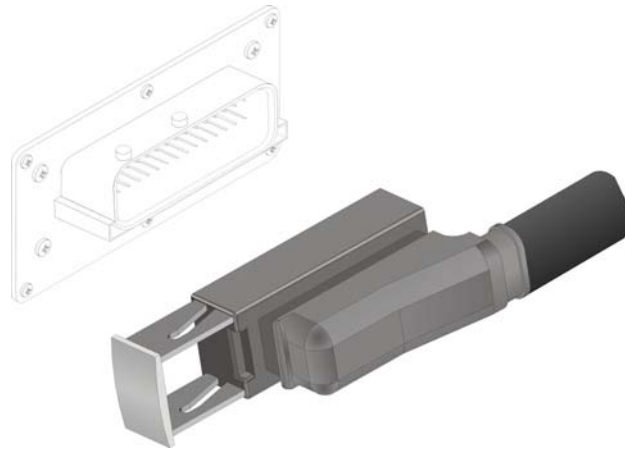
In [**Field Mode**], the machine's ground drive speed remains constant in spite of the acceleration of the engine required for the auxiliary functions.

The operator, now freed from controlling the speed, can concentrate on tasks with higher added value.



Auxiliaries

42-pin main connector



Characteristics	Description	AMP reference	Poclain Hydraulics part number	
Commercial name	KIT-CONNECTEUR-MAIN-SD-EASY		A02809D	
Components	AMP Connector	1-967281-1		
	AMP protective cover	0-965643-1		
	Power	7 AMP female contacts	929937-3	
		7 AMP insulants	828905-1	
		6 AMP stoppers	828922-1	
	Signals	40 AMP female contacts	962876-1	
		40 AMP insulants	963530-1	
		36 AMP stoppers	963531-1	
	Cable section	For power pins	1.5 to 2.5 mm ² [0.0023 to 0.004 in ²]	
For signal pins		0.5 to 1.0 mm ² [0.0008 to 0.0015 in ²]		
Insulation diameter	For power pins	2.2 to 3.0 mm ² [0.0034 to 0.0046 in ²]		
	For signal pins	1.4 to 1.9 mm ² [0.0021 to 0.003 in ²]		
Operating temperature	-40°C to 85°C [-40°F to 185°F]			
Ingress protection	IP 68			

Mounting tools for the connector

Description	AMP reference
Crimpers	539635-1
Chuck-jaw for power spindles	539737-2
Chuck-jaw for control spindles	539651-2
Extractor for power spindles	1-1579007-6
Extractor for control spindles	726534-1



Male connector communication



Commercial name	KIT CONNECTEUR MALE COM SD
Part number	A50515H
Compatibility	SmartDrive™ Easy, SmartDrive™ Auto

Features		
Manufacturer	AmphénoI	
Components	Receptacle	PT02A12-14P023
	Closing cap	BECN1207
	Seal	JE12
Wire range	0,38 to 0,93 mm ²	
Insulation diameter	1,2 to 2,4 mm	
Operating temperature	-55°C to +125°C [-67°F to 257°F]	
Ingress Protection	IP68	
Material	Aluminium with plated nickel	

Connector mounting

Strip the wires to a length of 5 mm [0.19 in].
Solder the wires onto the pins as shown in the table below.

N° pin SD Easyconnector	Function	N° pin male communication connector
7	5V RS 232	A
12	CAN L	E, F
26	RX RS 232	H
14	CAN H 120	K
27	TX RS 232	L
13	CAN H	M, N
42	Ground	P, R



Risk of damage to the serial port of the ECU.

When connecting an external equipment working with the RS232 link, be sure to connect as following:

- RX RS 232 (Easy) → TX RS232 (Various equipment)
- TX RS 232 (Easy) → RX RS232 (Various equipment)

Characteristics

Installation

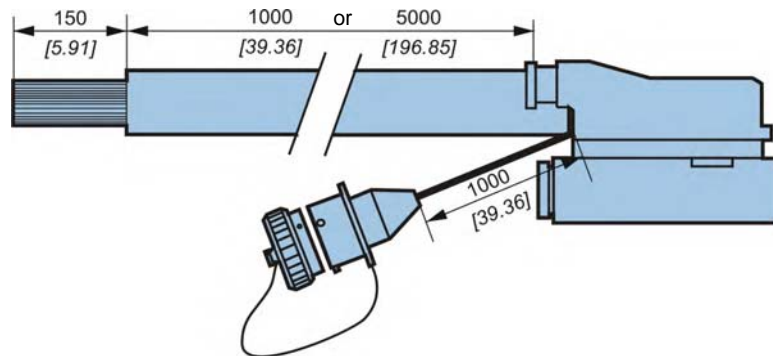


SmartDrive™ Easy cable



Commercial name	CABLE-SD-EASY-42-1000	CABLE-SD-EASY-42-5000
Part number	A20311C	A20313E
Function	Connect a SmartDrive™ Easy or SmartDrive™ Auto ECU to the machine wiring and have a communication connector.	
Compatibility	Transmission management with SmartDrive™ Easy or SmartDrive™ Auto ECU.	
Features		
Length of cable	1m	5m
Material	PVC	
Number of wires	42	
Sections of wires	1mm ²	

Layout



Electrical wiring

The wires of the cable are numbered.

Pin	Wire
1	1
2	2
3	3
⋮	⋮
26	Not connected
27	Not connected
⋮	⋮
⋮	⋮
⋮	⋮
42	42



The non used wires should be individually insulated because of possible voltage.

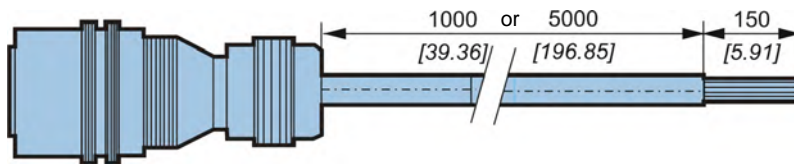


SmartDrive™ communication cable



Commercial name	COM-CABLE-SD-1000	COM-CABLE-SD-5000
Part number	A20360F	A20361G
Function	Connect a SmartDrive™ ECU communication elements to the machine wiring	
Compatibility	Electronic transmission management with SmartDrive™ ECU	
Features		
Length of cable	1m	5m
Material	PVC	
Number of wires	14	
Sections of wires	0.22mm ²	

Layout



Electrical wiring

Pin	Wire
A	White
B	Brown
C	Green
D	Yellow
E	Gray
F	Pink
H	Blue
J	Red
K	Black
L	Violet
M	Gray/Pink
N	Red/Blue
P	White/Green
R	Brown/Green



The non used wires should be individually insulated because of possible voltage.

Characteristics

Installation



The characteristics and installation of the components below are described in catalogue n° A01889D.

Joystick

Controls the direction of the ground drive and provides the acceleration/deceleration and speed settings.

Suspended or floor pedal

Controls the direction of the ground drive and provides the acceleration/deceleration and speed settings. Another pedal can also be used for braking.

Position sensors

These potentiometers (rotary or linear) are linked to controls other than those described above, which already incorporate a potentiometer. They indicate the position of the control levers.

Pressure sensors

They inform the ECU of the High Pressure Line pressure (from the 600-bar sensor) and the brake circuit pressure (from the 160-bar sensor).

Analogical temperature sensor

It informs the ECU of the High Temperature in the hydraulic circuit which can activate damaged modes (e.g.: translation speed decreasing in case of overheating).

Options

Speed sensor.

See the motor technical catalogues.

PC PHASES software combined with SmartDrive™ Easy

PHASES™ enables :

Set-up

The settings of the SmartDrive™ Easy may need to be changed if there is a change in characteristics or operating conditions.

The PHASES™ software manages 3 access levels to settings:

- Service,
- Manufacturer,
- Expert.

The last two levels are restricted to technicians with specific training (access restricted through password).

Downloading

Using a PC and the PHASES™ software allows to :

- Download the software to the SmartDrive™ Easy;
- Send and retrieve set-up files.

The hand held terminal only allows you to modify the data item per item.



Any modification of the value of a setting must be carried out by a qualified engineer trained by the machine manufacturer. The Poclain Hydraulics technical support team can advise you in defining your settings.

Modifications to the settings may require a new qualification of the machine. If in doubt, contact your Poclain Hydraulics sales engineer.

Calibration

The PHASES™ software allows to calibrate the minimum, maximum and neutral positions of the sensors installed on the machine in order to optimize the system's operation.



For further information, see PHASES™ user guide no. 801378162C and HHT user guide no. A06618T.

Diagnostics

The PHASES™ software enables the user to download the system's operating data. The data collected is used to identify possible malfunctions. Likewise, the hand held terminal is used to identify a malfunction through a system of codes and error messages.

Study of the system

Our sales engineers will analyze your specific needs to facilitate the integration of Poclain Hydraulics components into your system.

Training

Available on request.



Identification of the component



- A : Model code
e.g. SD-EASY-PLUS
- B : Code (Part number):
e.g. B20252M
- C : Serial number (Shop number):
e.g. 01
- D : Number (Number of chronological order):
e.g. 7572
- E : Country of manufacturing
- F : Place of manufacturing



The part number must be given for all replacement part orders.

Characteristics

Installation

**List of SmartDrive™ Easy components****ECU and its connections**

	Commercial name	Part number
REGULATING ECU	SD-EASY-EXTENDED	B20253N
BOX CONNECTOR	KIT-CONNECTEUR-MAIN-SD-EASY	A02809D
COM SD MALE CONNECTOR KIT	KIT-CONNECTEUR-MALE-COM-SD	A50515H
SMARTDRIVE EASY CABLE (1 m)	CABLE-SD-EASY-42-1000	A20311C
SMARTDRIVE EASY CABLE (5 m)	CABLE-SD-EASY-42-5000	A20313E
COMMUNICATION CABLE (1 m)	COM-CABLE-SD-1000	A20360F
COMMUNICATION CABLE (5 m)	COM-CABLE-SD-5000	A20361G
CONNECTORS (For ECU and sensors)	KIT-CONNECTEUR-SD-EASY	A13016X

Setting parameters

	Commercial name	Part number
CONTROL SOFTWARE (including SD PC LT cable)	PHASES Easy	A04903E
CABLE (extra)	CABLE SD PC LT	006142212S
SETUP TERMINAL (including SD HHT LT cable)	TERMINAL EQ. ST2000	005142202A
CABLE (extra)	CABLE SD HHT LT	006142213T
SD EASY COM ADAPTER	CABLE DE COM SD EASY	A05362D

Auxiliaries

	Commercial name	Part number
600-bar PRESSURE SENSOR - 1/4G connection	PRES-SENS-600B-G1/4-MP3	B58367R
160-bar PRESSURE SENSOR - 1/4G connection	PRES-SENS-160B-G1/4-MP3	B58365P
600-bar PRESSURE SENSOR - 9/16 connection	PRES-SENS-600B-9/16-MP3	B58366Q
160-bar PRESSURE SENSOR - M10 connection	PRES-SENS-160B-M10-MP3	B58364N
PRESSURE SENSOR CABLE	CABLE-PRESSURE-SENSOR-3M	003141105U
ANALOG TEMPERATURE SENSOR	TEMP-SENS-G1/4-M12-7	B45088H
M12 CABLE FOR TEMPERATURE SENSOR	ELEC-CABLE-M12-180°-5000	A07468S
	ELEC-CABLE-M12-90°-5000	A04999J

Control elements

	Commercial name	Part number
FLOOR PEDAL (provided with connector)	ELEC-HORIZ-PEDAL-30°-DUAL	A50838J
JOYSTICK (provided with connector)	JOYSTICK-35°-HANDLE-LOCK	003442799X
STEERING SENSOR CONNECTOR	KIT CONNECTEUR CAPT VIRAGE	007142222K
	KIT CONNECTEUR CAPT CDE SA	007142212Z

Hydraulic motor environment

	Commercial name	Part number
SPEED SENSOR	SPD-SENS-T4-12-44	B61287Q
	SPD-SENS-T4-12-53	B61288R
	SPD-SENS-T4-12-62	B61289S
M12 CABLE FOR SPEED SENSOR	ELEC-CABLE-M12-180°-5000	A07468S
	ELEC-CABLE-M12-90°-5000	A04999J



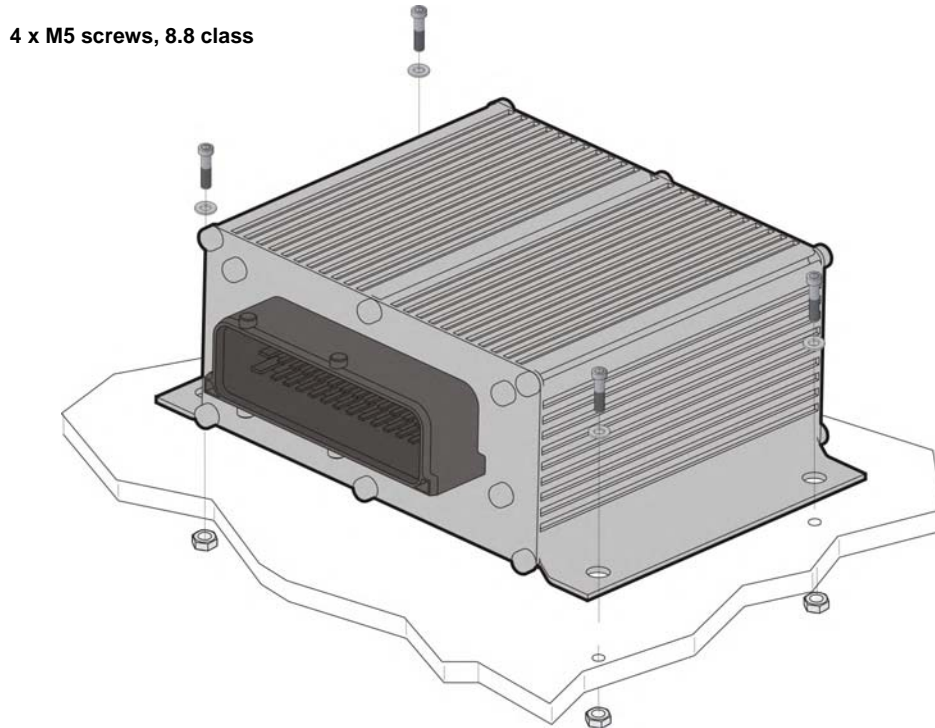
Commercial codes and item numbers may change during the lifetime of the system. Contact your Poclain Hydraulics sales engineer.



INSTALLATION

Fitting the ECU

The ECU must be fixed on a rigid support. Make sure that there is enough space to fit the connector.



Machine wiring recommendations

- All the cables must be encased in flexible metal or plastic sheaths;
- All cables or sheaths must be held well in place and locked in to prevent pull-out;
- Bring the sheath supports close together;
- The sheaths must be able to slide into the anchoring;
- Avoid mechanical stresses in the cables;
- Do not place the cables or sheaths close to moving or vibrating parts;
- Do not lay the sheaths along sharp angles. Protect them at each bend;
- Avoid laying the sheaths too close to high heat sources;
- Use wires with abrasion-resistant sheaths;
- Use cables that resist temperatures between 85°C and 105°C close to heat sources;
- Separate power cables from control cables;
- Pass the cables inside the machine, ensuring as much contact as possible with metal surfaces (steel). This will act as a shield against electromagnetic radiation.

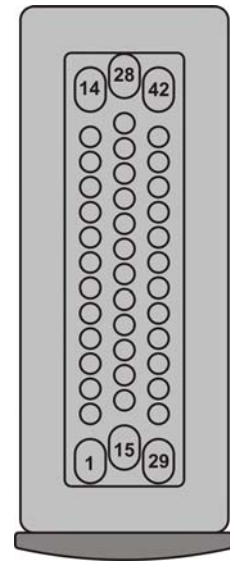


Description of pins

Number each wire using numbered plastic rings. Each cable must be securely fixed to the machine with clips placed every 20 cm. Sections are given (for information only) in mm² for a 10 meter length at an operating temperature of < 80 °C [176 °F].

PIN	J1	Function	Wire section mm ²
1	VBAT+	Battery power (+)	1.5 to 2.5
2	NC	Not connected	
3	NC	Not connected	
4	POUT1	Digital output 1	0.5 to 1
5	POUT4	Digital output 4	0.5 to 1
6	PWM1(-) 2A	PWM1 terminal (-) in case of 2A command	0.5 to 1
7	5 V OUT	5V sensors power supply	0.5 to 1
8	12V OUT	12V sensors power supply	0.5 to 1
9	ANIN3	Analog input 3	0.5 to 1
10	FIN2_DIF+	Differential frequency input 2 (+)	0.5 to 1
11	DIN5	Digital input 5	0.5 to 1
12	CANL	Low CAN signal	0.5 to 1
13	CANH	High CAN signal	0.5 to 1
14	CANH_120	Connexion for CAN bus end 120 U	0.5 to 1
15	ANA GND	Analog input ground	1.5 to 2.5
16	PWM2(+)	PWM2 (+) terminal	0.5 to 1
17	PWM4(+)	PWM4 (+) terminal	0.5 to 1
18	POUT3	Digital output 3	0.5 to 1
19	PWM2(-) 2A	PWM2 terminal (-) in case of 2A command	0.5 to 1
20	PWM2(-) 120mA	PWM2 terminal (-) in case of 120 mA command	0.5 to 1
21	PWM4(-)	PWM4 (-) terminal	0.5 to 1
22	ANIN2	Analog input 2	0.5 to 1
23	ANIN5	Analog input 5	0.5 to 1
24	FIN2_DIF-	Differential frequency input 2 (-)	0.5 to 1
25	DIN4	Digital input 4	0.5 to 1
26	RX232	Receive signal (serial link)	0.5 to 1
27	TX232	Transmit signal (serial link)	0.5 to 1
28	VBAT- (GND)	Battery power (-) (ground)	1.5 to 2.5
29	VBAT+	Battery power supply (+)	1.5 to 2.5
30	PWM1(+)	PWM1(+) terminal	0.5 to 1
31	PWM3(+)	PWM3 (+) terminal	0.5 to 1
32	POUT2	Digital output 2	0.5 to 1
33	5 V OUT	5V sensors power supply	0.5 to 1
34	PWM1(-) 120mA	PWM1 terminal (-) in case of 120 mA command	0.5 to 1
35	PWM3(-)	PWM3 (-) terminal	0.5 to 1
36	ANIN1	Analog input 1	0.5 to 1
37	ANIN4	Analog input 4	0.5 to 1
38	FIN1	Frequency input 1	0.5 to 1
39	DIN1	Digital input 1	0.5 to 1
40	DIN2	Digital input 2	0.5 to 1
41	DIN3	Digital input 3	0.5 to 1
42	VBAT- (GND)	Battery power (-) (ground)	1.5 to 2.5

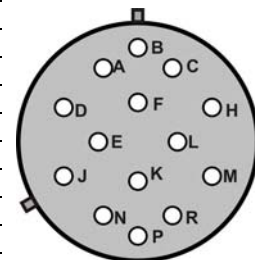
ECU side view



Communication cable

PIN	J1	Function	Wire section mm ²
A	5V OUT	5V sensors power supply	0.22
B	NC	Not connected	
C	NC	Not connected	
D	NC	Not connected	
E	CANL	Low CAN signal	0.22
F	CANL	Low CAN signal	0.22
H	RxRS232	Receive signal (serial link)	0.22
J	NC	Not connected	
K	CANH_120	Connexion for CAN bus end 120 U	0.22
L	TxRS232	Transmit signal (serial link)	0.22
M	CANH	High CAN signal	0.22
N	CANH	High CAN signal	0.22
P	GND	ground	0.22
R	GND	ground	0.22

ECU side view





Machine safety recommendations



The machine manufacturer is responsible for safety measures during the installation of our products. They must comply with applicable laws in the country or state.



Poclain Hydraulics recommends that you first do the wiring for an emergency stop button that can be easily accessed by the driver. The button should stop the engine and cut off the power supply of the SmartDrive™ Easy.



All calculator and sensors connectors must be unplugged during electrical welding operations.

A lamp on the dashboard must be wired parallel to the parking brake operating coil to give the actual status of the parking brake. The logic must be as follows:

- Lamp on, parking brake applied;
- Lamp off, parking brake released.



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

Sensors



Sensors must be powered at (0V 5V) with the exception of wheel speed and thermal sensors that need to be powered at (0V 12V). The proportional sensors used must have a variation range of (0.5V to 4.5V) at the output.

5V Power supply: $0.5V < \text{output signal} < 4.5V$, signal weaker at rest than when operating, for example in the case of a pedal.

Potentiometer sensor specifications:

- Resistance $< 5\text{ k}\Omega$
- $1\text{ k}\Omega < \text{sensor resistance} < 10\text{ k}\Omega$ (5kΩ recommended)

A joystick must have at least 1 switch open in neutral, that is otherwise closed.

The switch in neutral can be replaced by a forward switch and a reverse switch that are both open in neutral and closed depending on the required direction.

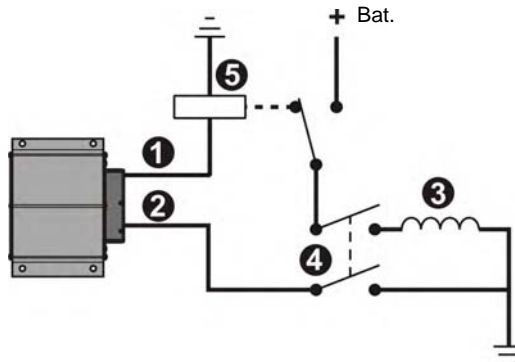
- The ground of the analog sensors must be directly connected to SmartDrive™ Easy analog ground (pin n°15). This analog ground has not to be connected to VBAT-(ground) or vehicle chassis.

Parking brake wiring recommendations

If the ECU controls also the parking brake, you must IMPERATIVELY wire as shown opposite.

Warning: The switch used must-to be able to carry the current which circulates in the solenoid brake (current can exceed 2 amperes).

- 1- Exit orders parking brake.
- 2- Entry On/Off sensor.
- 3- Solenoid of parking brake (if supplied = brake not applied).
- 4- Switch of parking brake.
- 5- Solenoid relay.



This wiring can authorise parking brake application by driver or by SmartDrive™ Easy.

Characteristics

Installation



Installing the program

To work, your system needs a SmartDrive™ Easy ECU as well as the on-board software that will be loaded onto the computer. There are two ways of loading the software.

- **First solution:**

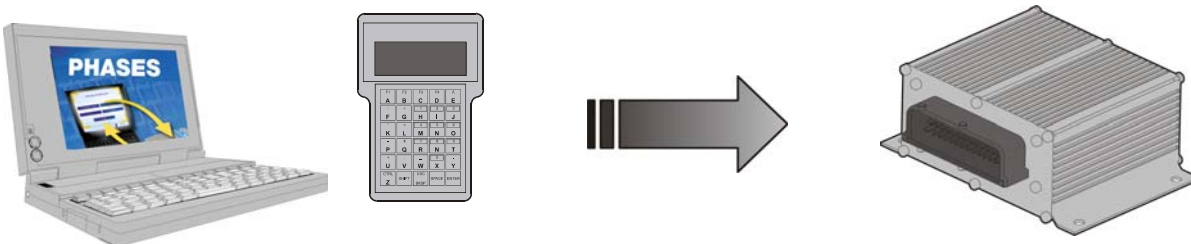
Poclain Hydraulics or your distributor has sent you the on-board software on a CD-rom, by e-mail or by another means. Use the PC PHASES™ Easy software to transfer the application to the SmartDrive™ Easy ECU.

- **Second solution:**

You design your application directly with the PC PHASES™ Easy Design software. Follow the instructions described in documentation N°801378162C and then use PHASES™ Easy Design to transfer the software to the SmartDrive™ Easy ECU.

System set-up

Use the PHASES software to set up the system.



For further information about the PHASES™ software application, consult the online help or PHASES™ catalogue.



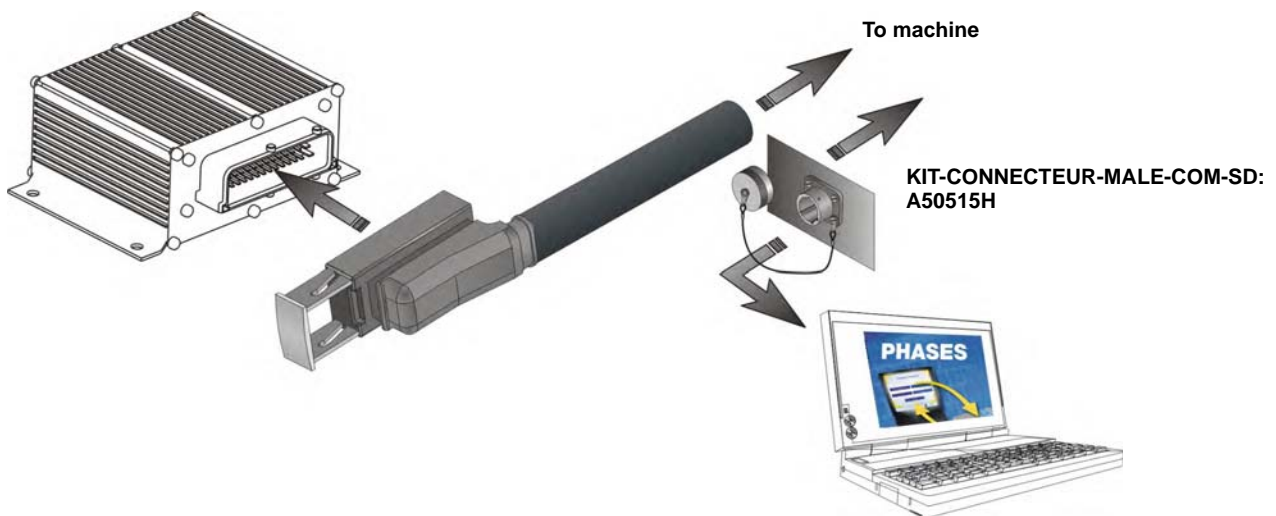
For further information, see PHASES™ user guide no. 801378162C and hand held terminal user guide no. A06618T.

Set-up with the PHASES software application

Install the PHASES™ Easy software (see installation guide n° 801378162C).

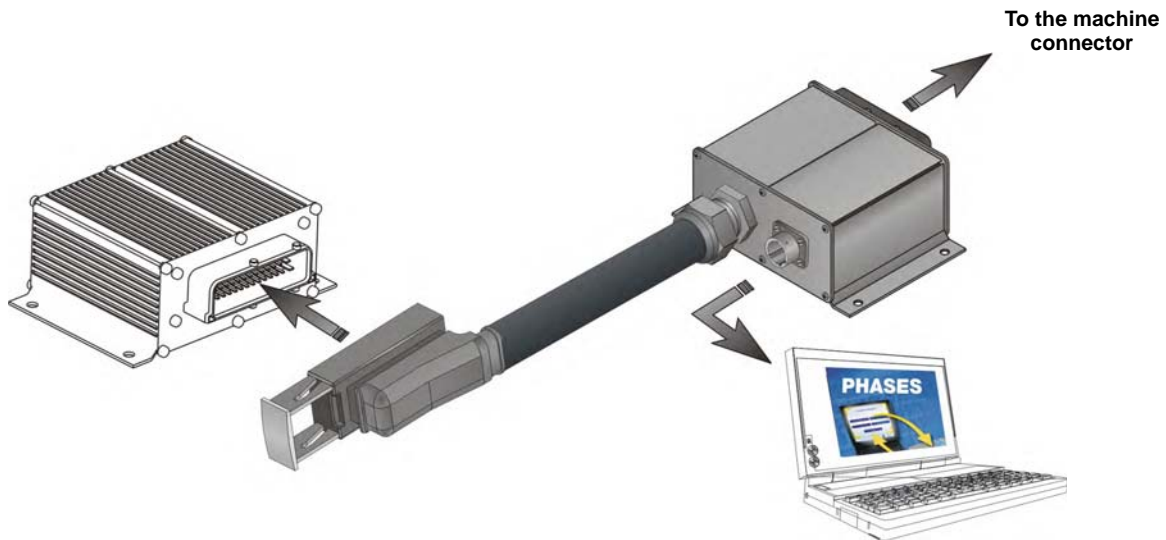
Connect the ECU to the PC with the CABLE SD PC LT cable by connecting the PC's SUBD9 to the ECU's communication connector (serial link). We propose three solutions for communicating with the SmartDrive™ Easy ECU:

1 - Via the communication connector installed on the machine. For the wiring of the connector see the table on page 16.

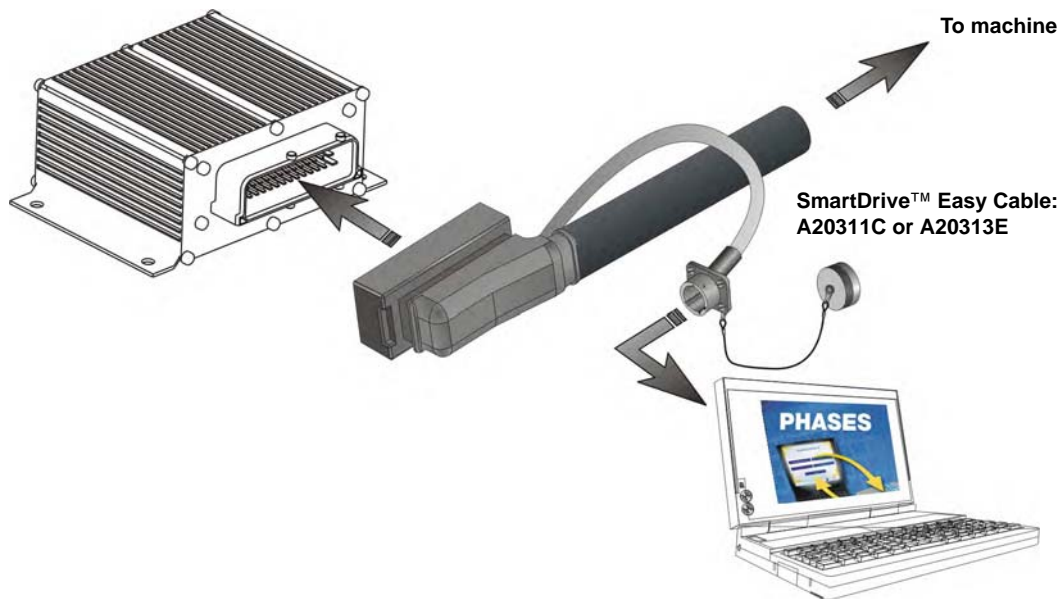




2 - Via the SmartDrive™ Easy communication adapter (Part number: A05362D). See the diagram below.



3 - Via SmartDrive™ Easy cable. See the diagram below.



Set-up with the hand held terminal (HHT)

The hand held terminal is used only to modify the settings directly in the ECU. There is no way of saving a configuration file. Connect the ECU to the hand held terminal with the CABLE SD HHT LT cable. See user guide n° A06618T to set the system with the hand held terminal.

Checking the installation before starting up



The elements to be checked depend on the application of each vehicle. Please remember that each manufacturer is ultimately responsible for checking their machinery at the end of the line.

Characteristics

Installation



Checking of the electrical environment

The PHASES™ software enables you to view any anomalies detected by the SmartDrive™ Easy ECU, by delivering an error code, a brief explanation and a list of possible causes. In particular, it indicates:

- Short-circuit type electrical anomalies on the ground, or the 5V;
- Cabling errors: switch allocated/not allocated to a given part;
- input/output malfunctions.

The hand held terminal can also check these points without help files.



Calibration can detect cable configuration errors (see next chapter).

First level diagnostic

Fault warning lamp on dashboard:

The warning lamp flashes if there is a fault. Otherwise, it remains off.

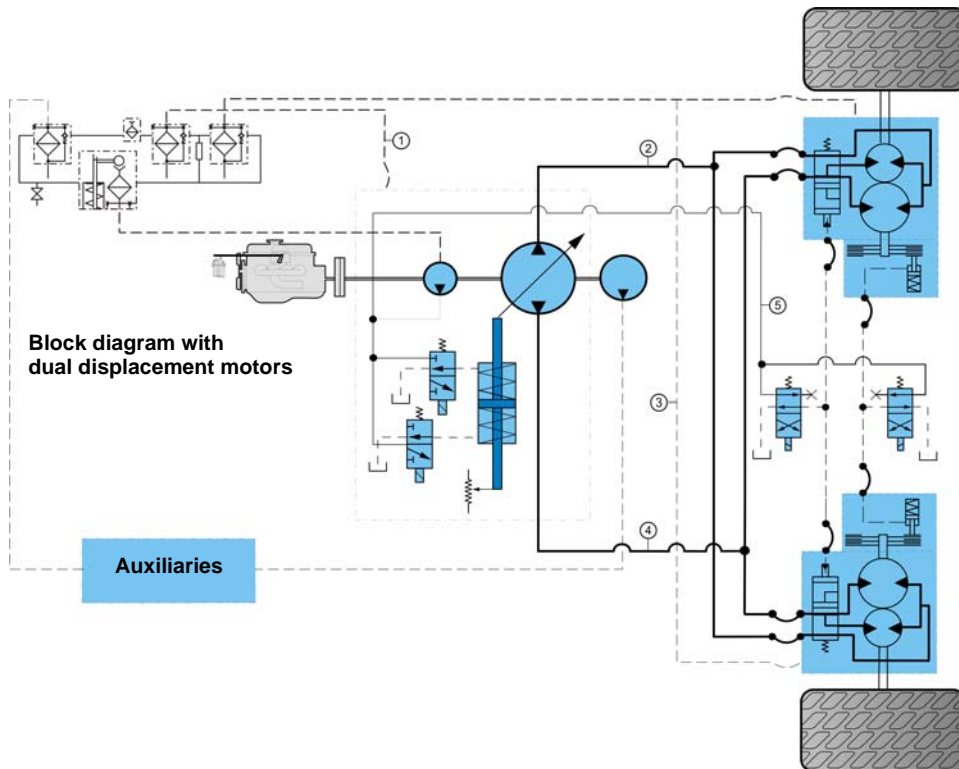
Checking of the hydraulic environment



Refer to the information on commissioning provided in the "Motor generic installation" brochure n° 801478197L.

Checking of hydraulic pressures

Fit the machine temporarily with pressure gauges and check the against the table below.



Pressure gauge	Pressure bar [PSI]	Informations
1	0 - 4 [0 - 58]	Pump case pressure
2	0 - 450 [0 - 6 530]	HP (high pressure) pressure supply
3	0 - 4 [0 - 58]	Motor case pressure
4	0 - 450 [0 - 6 530]	HP (high pressure) pressure supply
5	0 - 40 [0 - 580]	Charge pressure



Starting up the engine



Place the machine on the wheel blocks.
Set up a safety area.
Observe all personnel safety instructions.

Put the **F/N/R** (Forward/Neutral/Reverse) shift lever in the neutral position. Apply the parking brake.
Switch on the ECU.
Start the engine, and wait until the charge pressure is established.



Press the emergency stop button and check that it stops the engine and cuts off power to the SmartDrive™ Easy ECU.

Start the engine again and then use the PHASES™ software in the input/output diagnostic module to check that the readings of the various sensors (switch, potentiometer sensors, etc.) are displayed correctly when you actuate them.

Calibrating all the parts

This calibration can be carried out using either PHASES™ or the HHT. See their respective user manuals.

Activating pump displacement

Release the parking brake.
Put the **F/N/R** shift lever (or switch or joystick) in the Forward Drive position.
Gently depress the travel pedal; the wheels must turn slowly forward.



Limit the wheel rotation speed to 10% of their maximum speed when the machine is on wheel blocks.

Check the pressure levels.

Checking the system's specific functions on wheel blocks

The forward/reverse ground drive direction using the joystick or switch.

Return to neutral

- Put the gear shift in neutral when in ground drive: the machine will decelerate in accordance with the programmed deceleration ramp.

Reversal

- Reverse when in ground drive: the wheels of the machine will decelerate then accelerate in the opposite direction depending on the pedal position.

Braking

- Test the parking brake: activating it deactivates the travel pedal.
- Test the emergency brake by fully depressing the brake pedal.

Checking that the system works on wheels

Repeat the previous tests (except tests of braking).
Test the functions that are specific to your application (anti-stall, cruise control, etc)



A functional check of the parking brake must be carried out each time it is used as an auxiliary brake (or emergency brake). For all vehicles capable of speeds over 25 km/h, please contact your Poclair Hydraulics application engineer.



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