Tech Note

CAN bus components

Introduction

HN.50.Y1.02 is new

Introduction

Danfoss has introduced a new remote control system with CAN bus components that will give customers greater flexibility as far as their particular application needs are concerned. In the new series, focus has been particularly concentrated on:

- Improved performance
- Lower installation costs
- Easier servicing
- Improved safety
- Flexibility

CAN components can be used together with PVG 32, PVG 120 and PVG 83.

What is CAN bus

The CAN (Controller Area Network) bus was originally designed for the automobile industry. It is a serial communication interface in which special emphasis is placed on the following parameters:

- Safety
- Reliability
- Real time control
- Costs (installation/service)

CAN communication

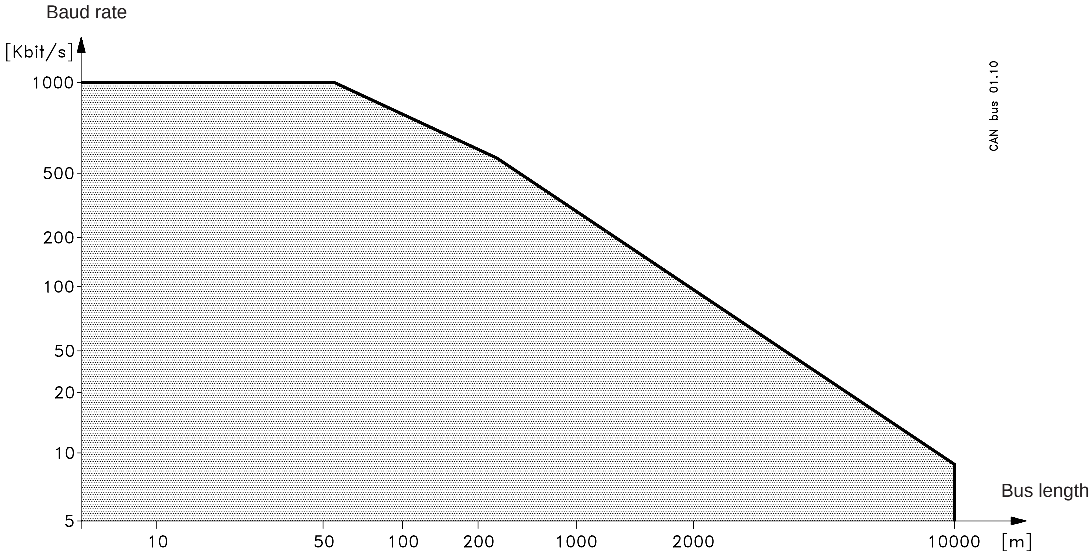
CAN communication is best understood in the following way:

Instead of sending a message from component A to unit B, it is broadcast. Each component, a PVG CIP for example, is then able to listen in and col-lect information relevant to it selv. The message format is designated COB (Communication Object), which applies to all messages.

A COB has an identification code (COB-ID) that makes it possible for a component, a PVG CIP for example, to sort and prioritise transmitted communication objects (COBs). The COB-ID clearly identifies the COB in a network.

CAN communication works on the prioritising of messages, thus CAN uses familiar and established methods such as CSMA/CA (Carrier Sense, Multiple Access with Collision Avoidance) with improved capability to avoid collision (non-destructive bit arbitration). This means that the message with the lowest identification code will have access to the bus before other messages, ensuring that the capacity of the bus can be utilised to the maximum.

The speed of the bus is limited by its length, see below.



CANopen

CAN components communicate using a protocol. A protocol can be compared to a language. The different protocols on the market are adapted to the applications in which they are used.
The CANopen protocol is particularly suitable for mobile applications. There are many suppliers on the market whose products work together with CANopen, therefore it is easy to put together a comprehensive CANopen system.

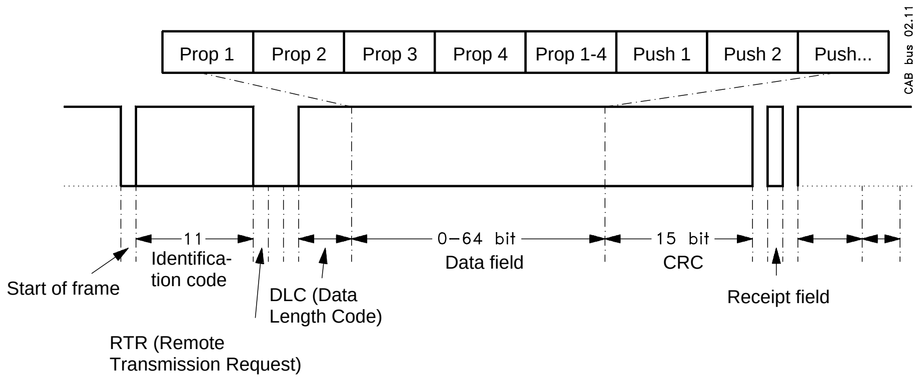
CANopen uses objects for communication. The most common are:

Service Data Object(SDO)
SDOs transfer large amounts of information that is not time-critical eg setting-up parameters.

Process Data Object (PDO)
PDOs are used to transfer data that are time-critical. For example, joysticks transfer signals via PDOs.

NMT is a special part that handles emergency situations and other network administration.
Via an emergency object, the individual nodes (components) are able to send a warning of emergency situations. In this way, other CANopen components are able to identify the node point from which the emergency call was sent.

CANopen specifies an Object Dictionary (OD) that describes all parameters in the product. This OD does not function solely as a specification file, but also as an interface with other CANopen devices. In other words, a description is given detailing which parameters are necessary to activate the different functions the product can perform.



The example above shows the structure of a joystick COB.

1. A COB is started by sending a 0 (start of frame).
2. An identification code (COB-ID) is sent and through bit arbitration the message having the lowest bit identification code is allowed to continue.
3. RTR (Remote Transmission Request) specifies whether the sender wishes to receive or send data to the message receiver.
4. DLC specifies the length of the data field.
5. The data field contains information on, for example, joystick data.
6. The CRC field is used as a safety control for finding bit error.
7. The receipt field is a position in which all other components acknowledge receiving a message.

Danfoss CAN concept

CAN components supplied by Danfoss can be identified from the abbreviation CIP (CAN Interfaced Product). We supply the following:

- PVG CIP
- Prof 1 CIP
- CIP Configuration Tool

Our objective is to supply CAN components which are not only capable of communicating with our own products, but also with other standard available components. There are many suppliers of CANopen components on the market and therefore it is simple, inexpensive and very flexible to set up a comprehensive system.

The CIP Configuration Tool is designed to guide hydraulic system designers/ service technicians through system setup.

Prof 1 CIP

The Prof 1 CIP joystick is available in many mechanical configurations. To simplify the way in which this information is shown in the COB, the maximum configuration possibilities are always built in. Depending on the actual configuration of the joystick, some of the fields for proportional or on/off signals contain no information. The joystick sends information on the first PDO (Process Data Object). As standard, it sends cyclically at T_c = 10 ms.
The Emergency Object is used if a fault arises in the joystick.

Prof 1 CIP can be ordered as described in Tech Note HN.50.Z3 Joystick Prof 1. New modules for Prof 1 CIP are shown in the table below.

Prof 1 CIP contains new functions often requested in hydraulic systems:

Joystick guide (x - y interlook)
This function ensures that only the first proportional signal activated from the control lever is sent (prop 1 or prop 2).

Memory function
This function makes it possible for the user to hold a proportional function by pressing a selected memory button (on/off) in the joystick. The associated proportional signal can be deactivated by pressing the memory button again or by activating the proportional function in the opposite direction.

Name	Code no. 162B....	Pos. no. in code no. list	Description
Cable	6100	6	Length 230 mm with AMP 282404-1, male plug AMP 282107-1, tab house
Main function module with electronics	5100	5	CAN electronics

PVG CIP

PVG CIP is designed to control up to eight sections equipped with PVEO, PVEM, PVEH or PVES, and versions with float position control.
PVG CIP is able to receive COBs sent in joystick format from four joysticks or other sources. The joystick signals are distributed to the PVEs in relation to the actual setup. The CAN signals are converted to proportional or on/off values on the output pins of the module.
PVG CIP contains functions often used in hydraulic systems:

- Two different ramps (principle 1 from EH boxes)
- Flow limitation
- Deadband compensation
- Gain
- Software tuning of spool characteristics
- Spool float position control
- Power saving
- Service and diagnosing
- Softwiring

PVG CIP must be ordered as a separate component with code number as follows.

Name	Code no. 155U....	Description
PVG CIP	5660	With AMP plug 1-967280-1, male plug

CIP Configuration Tool

The CIP Configuration Tool is a program developed for setting up systems consisting of PVG CIP and Prof 1 CIP.

Name	Code no. 155U....	Description
CIP Configuration Tool	5670	Product contents • CIP Configuration Tool • CIP Downloading Utility • CANview • CAN dongle • Documentation, examples, help files

Technical data

Common to PVG CIP & Prof 1 CIP

Power supply

Supply voltage	U_{dc}	10 - 30 V DC
Max. supply voltage		36 V DC
Max. pulsation (peak to peak)		5%

CAN interface - ISO 11898 ver. 2.0 B

Baud rate	10 Kbit/s - 1000 Kbit/s
Communication profile	CANopen ver. 3.0
Typical start-up time	< 500 ms
CAN	Full CAN

EMC - EMC Directive (89/336/ECC)

Emission	EN 50081-2
Immunity	EN 50082-2
HF immunity	ISO 14892 (60 V/m, 20 MHz - 1000 MHz)
	ISO 13766 (60 V/m, 20 MHz - 1000 MHz)

Environmental data

Ambient temperature	Storage temperature	-40°C to +90°C
	Operating temperature	-30°C to +70°C

Termination

A CAN bus must be terminated at both ends where CAN+ and CAN- are to be connected via a 120 Ω resistor.

Termination can be effected by connecting a jumper between the pins given below (a 120 Ω resistor is fitted in the component).

Prof 1 CIP	
CAN_TERM	Pin 1
CAN+	Pin 4

PVG CIP	
CAN_TERM	Pin 16
CAN+	Pin 3

References

ISO 11898	Vehicles, interchange of digital information - Controller Area Network (CAN) for high-speed communication
CANopen	CANopen communication profile for industrial systems, CiA standard draft 3.0 Revision 3.0
EMC Directive	89/336/ECC
ISO 14892	Agricultural and forestry machines - electromagnetic compatibility
ISO 13766	Earth-moving machinery - electromagnetic compatibility

Prof 1 CIP data format

The data format is independent of the mechanical configuration. It is manufactured so that a signal for an 8-bit processor can be extracted without signal manipulation. This gives 8-bit signal resolution, and in order to get full resolution (10 bit) signal manipulation is necessary. This is standard on PVG CIP. The data format is “twos complement” and is shown in the figure below.

1 byte	SIGN----MSB --Prop1--							
2 byte	SIGN----MSB --Prop2--							
3 byte	SIGN----MSB --Prop3--							
4 byte	SIGN----MSB --Prop4--							
5 byte	rest_Prop4 - LSB		rest_Prop3 - LSB		rest_Prop2 - LSB		rest_Prop1 - LSB	
6 byte	Push 8	Push 7	Push 6	Push 5	Push 4B	Push 4A	Push 3B	Push 3A
	8 bit	7 bit	6 bit	5 bit	4 bit	3 bit	2 bit	1 bit

SIGN = +/–
MSB = Most significant bit
LSB = Least significant bit

PVG CIP specification

Electrical

PVE outputs	8
PVE types that can be connected	PVEO, PVEM, PVEH, PVES incl. versions with float position
PVPX/PVPE outputs	1
Resolution	9 bit (-100% to +100%)
Plug type (Only part no. 1-967280-1 supplied with PVG)	AMP part no. 1-967280-1, PCB-connector
	AMP part no. 1-967281-1, Timer house
	AMP part 0-929937-1, junior contact
	AMP part 0-962876-2, micro contact
	AMP part no. 0-965643-1, cover
	Seals and plugs
CAN setting	Slave only

Plug connections

Pin number	Name	
1	PVPX out	
2	CAN+	
3	CAN+	
4	Alarm_1	
5	Alarm_2	
6	Gnd	
7	Alarm_3	
8	Alarm_4	
9	Alarm_5	
10	Gnd	
11	Alarm_6	
12	Alarm_7	
13	Alarm_8	
14	Gnd	
15	U_{dc}	
16	CAN_TERM	
17	Gnd	
18	PVE1_A ♣	PVE1 signal ∇
19	PVE2_A ♣	PVE2 signal ∇
20	PVE3_A ♣	PVE3 signal ∇
21	Gnd	

Pin number	Name	
22	PVE4_A ♣	PVE4 signal ∇
23	PVE5_A ♣	PVE5 signal ∇
24	PVE6_A ♣	PVE6 signal ∇
25	Gnd	
26	PVE7_A ♣	PVE7 signal ∇
27	PVE8_A ♣	PVE8 signal ∇
28	Gnd	
29	U_{dc}	
30	CAN-	
31	CAN-	
32	PVE1_B ♣	PVE1 U_{dc} ∇
33	PVE2_B ♣	PVE2 U_{dc} ∇
34	PVE3_B ♣	PVE3 U_{dc} ∇
35	Gnd	
36	PVE4_B ♣	PVE4 U_{dc} ∇
37	PVE5_B ♣	PVE5 U_{dc} ∇
38	PVE6_B ♣	PVE6 U_{dc} ∇
39	Gnd	
40	PVE7_B ♣	PVE7 U_{dc} ∇
41	PVE8_B ♣	PVE8 U_{dc} ∇
42	Gnd	

♣ When using PVEO
∇ When using PVEM/H/S

PVEM/H/S

Voltage, neutral position		50% of U_{dc}
Voltage, full flow port A		25% of U_{dc}
	Version with float position control	35% of U_{dc}
Voltage, full flow port B		75% of U_{dc}
	Version with float position control	65% of U_{dc}
Voltage, float position control	Version with float position control	80% of U_{dc}
Alarm input signals	Low	< 1,6 V
	High	> 85% of U_{dc}
Max. linearity deviation		3%
Max. pulsation content	(f > 2 kHz)	5%
Max. band width		10 Hz
Max. output current		± 1 mA

PVEO

Max. output current	1,2 A

PVPE/PVPX

Max. output current	3 A

Note: To ensure maximum safety, the normally open (NO) version of PVPE/PVPX is recommended.

Environmental data

IP classification	IP 66, IEC 529

Prof 1 CIP specification

Electrical

Proportional signals max.		4
Resolution		9 bit (-100% to +100%)
Operating buttons on/off max.		6
DIP switch settings	DIP no. 1	Open = CANopen min. master
		Closed = CANopen slave
DIP switch settings	DIP no. 2	Open = Default baudrate and Node id
		Closed = Baudrate and Node id acc. to OD
Plug type Only part no. 282404-1 and no. 282107-1 supplied		AMP part no. 282404-1, male plug
		AMP part no. 282403-1, female plug
		AMP 282107-1, tab house
		AMP 282089-1, plug house
		Seals and plugs

Plug connections

Pin number	Name
1	CAN_TERM
2	U_{dc}
3	Frame
4	CAN+
5	CAN-

Environmental/mechanical

As analog version

Safety aspects

Both PVG CIP and Prof 1 CIP are designed to give maximum safety. They both incorporate self-test functions, signal protection and ‘watchdogs.

The self-test is performed when power is applied and before any of the PVE outputs are activated. The unit then goes to the operating function and a series of running tests are carried out. A list of these tests is given below.

Self-tests

PVG CIP

1. Internal RAM test
2. External RAM test
3. EE-PROM test
4. FLASH test
5. Test of feedback monitoring (tests all outputs for short-circuiting to earth and U_{dc})

Prof 1 CIP

1. Internal RAM test
2. EE-PROM test
3. FLASH test

Running tests

PVG CIP

1. Watchdog
2. PVEH alarms
3. Signal protection

Prof 1 CIP

1. Watchdog
2. Potentiometer control

To ensure optimum system function, two safety levels are used:

- Fail-safe condition
- Alarm condition

Fail-safe condition		Alarm condition
PVG CIP	Prof 1 CIP	PVG CIP
PVE forced to neutral position. Voltage supply to PVE cut off.	Neutral position signal sent from the joystick to all PVEs.	Alarm signal sent on bus so that a third unit is able to take appropriate action.
Alarm signal sent on bus so that a third unit is able to take appropriate action.	Alarm signal sent on bus so that a third unit is able to take appropriate action.	Depending on OD-index 2108 subindex 1, PVPX/PVPE dump valve dumps pressure in alarm condition. Because this is an NO valve (normally open) voltage must be cut off.

Fail-safe condition arises when faults of the following types occur:

PVG CIP

Fault code HEX	Description	PVEs that go into fail-safe condition
1000	Generic fault	All PVEs
5000	System hardware	All PVEs
5001	Self-test fault, internal RAM	All PVEs
5002	Self-test fault, external RAM	All PVEs
5003	Self-test fault, EE-PROM	All PVEs
5004	Self-test fault, FLASH	All PVEs
5005	Self-test fault, feedback test # 1	PVE 1
5006	Self-test fault, feedback test # 2	PVE 2
5007	Self-test fault, feedback test # 3	PVE 3
5008	Self-test fault, feedback test # 4	PVE 4
5009	Self-test fault, feedback test # 5	PVE 5
500A	Self-test fault, feedback test # 6	PVE 6
500B	Self-test fault, feedback test # 7	PVE 7
500C	Self-test fault, feedback test # 8	PVE 8
500D	Self-test fault, feedback test PVPX	All PVEs
5016	Watchdog fault	All PVEs
6300	Joystick data format nonconformance	All PVEs
8100	Communication fault	No PVEs
8101	Protection fault PDO1	PVE controlled by PD01
8102	Protection fault PDO2	PVE controlled by PD02
8103	Protection fault PDO3	PVE controlled by PD03
8104	Protection fault PDO4	PVE controlled by PD04

Prof 1 CIP

Fault code hex	Description
1000	Generic fault
5000	System hardware
5001	Self-test fault, internal RAM
5003	Self-test fault, EE-PROM
5004	Self-test fault, FLASH
5005	Proportional voltage outside range
5007	Proportional signal registered without corresponding direction change
500F	Watchdog fault

Alarm condition arises on faults of the following types:

Fault code HEX	Description
500E	PVEH alarm # 1, pin 3
500F	PVEH alarm # 2, pin 3
5010	PVEH alarm # 3, pin 3
5011	PVEH alarm # 4, pin 3
5012	PVEH alarm # 5, pin 3
5013	PVEH alarm # 6, pin 3
5014	PVEH alarm # 7, pin 3
5015	PVEH alarm # 8, pin 3

The table below shows at which settings PVPX/PVPE dumps in alarm condition.

OD-index 2018 subindex 9 HEX	Activation of PVPX/PVPE
0	No PVPX => must not dump in alarm condition
1	PVPX can be controlled from an external source => must not dump in alarm condition
2	PVPX controlled from an external source, or by alarm condition => must dump in alarm condition

Introduction to PVG CIP

This component is located near the valve and acts as the interface between PVG and CAN bus. The interface can control up to eight PVEs and 1 PVPX/PVPE.

System parameters can be set in the OD (see overview, page 25), either by using CIP Configuration Tool or with a normal CANopen Configuration Tool.

Setting up PVG CIP can be divided into four main parts:

1) Identification of components
   a) Identification of PVE
   b) Identification of PVPX/PVPE

2) Setting up connections
   a) To other components on bus (Prof 1 CIP)
   b) Between data (joystick signals) and PVE/PVPX

3) Setting system-related parameters
   a) Baudrate
   b) Node identification
   c) Softwiring

4) Setting hydraulic-related parameters
   a) Deadband compensation
   b) Signal gain
   c) Flow limitation
   d) Software tuning of spool characteristics
   e) Ramps (individual on each port, two different settings for each port)
   f) Float position control
   g) Power saving

These components also contain facilities for fault location, servicing and restoring factory setting.

Component identification

To be able to communicate with PVG CIP it is necessary to identify the system components:

- Identification of PVE type
- Identification of PVPX/PVPE type

Identification of PVE type

Type identification is used to specify how PVG CIP is to control the PVEs. The types used are specified as follows:

Units	0: Not accessible
	1: PVEO
	2: PVEM
	3: PVEH/S
	4: PVEM (float position control)
	5: PVEH (float position control)
Max.	5
Min.	0
Standard	3 (PVEH/S)
Precision	1
OD index	2018 HEX

PVG CIP output/input will be on the following PVE pins, depending on type

PVE pins	PVEH/S	PVEM	PVEO
1	+	+	Port A
2	Signal	Signal	Port B
3	Alarm	N/A	N/A
⏚	Frame	Frame	Frame

Identification of PVPX

PVPX is used as a safety device for the PVG and dumps to tanks LS pressure in dangerous situations. With PVG CIP it is possible to select whether PVPX is to dump the LS pressure if a fault occurs in PVEH/PVES (pin 3).

In all cases of fault from a PVE of type PVEH/S, PVG CIP will automatically send a fault message on the bus so that an external controller or similar unit is able to react to the information. Whether PVPX is present and whether it must be activated in the case of a PVEH/PVES fault can be determined from the following table.

Note: If an extra component for control of the PVPX is not mapped, it will automatically be actuated upon start-up.

Units	-
	PVPX can be set as follows: 0. PVPX N/A 1. PVPX present • Controlled by external source, e.g. joystick or controller input 2. PVPX present: • Controlled by alarm signal from PVEH/S • Controlled by external source, e.g. joystick or controller input
Max.	-
Min.	-
Standard	0
Precision	-
OD index	2018 subindex 9 HEX

Connections to other components on bus

To set up which joystick or other sources the PVG CIP is to listen to, the relevant COB-ID must be set in the following OD index.
PVG CIP is able to listen to a maximum of four different COB-IDs.

Units	-
Max.	-
Min.	-
Standard	0
Precision	-
OD-index	1400 subindex 1 HEX 1401 subindex 1 HEX 1402 subindex 1 HEX 1403 subindex 1 HEX

Note: If some COB-IDs are not used, they must be set to zero.

Connections between data (joystick signals) and PVE, PVPX/PVPE

To set up the system the joystick on/off and proportional functions must be directed to the correct PVEs and PVPX/PVPE. This can be done by connecting the PVEs to the correct position on the COB. See example on page 21.

Control of dump valves
To ensure that an external controller or a joystick is able to control the PVPX, an on/off signal can be mapped to control it. Because it is NO (normally open) a constant voltage must be applied to PVPX/PVPE so that it does not dump the LS pressure and thereby deactivate the PVG. During an alarm condition, voltage must therefore be removed. In other words, if a joystick is used, the button that is mapped for PVPE/PVPX acts as a deadman's button.

Units	-
Max.	-
Min.	-
Standard	0
Precision	-
OD index	2104 HEX

System-related parameters

To be able to set up and service PVG CIP some system-related parameters have to be set:

- Baudrate
- Node identification
- Softwiring

Baudrate

The speed of communication must be set. The baudrate becomes effective after system reboot.

Note: The baudrates 10 and 800 are not supported by CIP Configuration Tool v.1.00.

Units	[kbit/s]
Max.	1000
Min.	10
Standard	250
Precision	*
OD index	201A HEX

* 10, 20, 50, 100, 125, 250, 500, 800, 1000.

Node identification

Node identification specifies the address PVG CIP has for the other CAN components (applies after system reboot).

Units	-
Max.	127
Min.	1
Standard	101
Precision	1
OD index	100B HEX

Softwiring

With softwiring it is possible for any joystick signal to be sent to one or more PVEs. Softwiring is made via an SDO, making it possible to introduce changes during operation. See example on page 21.

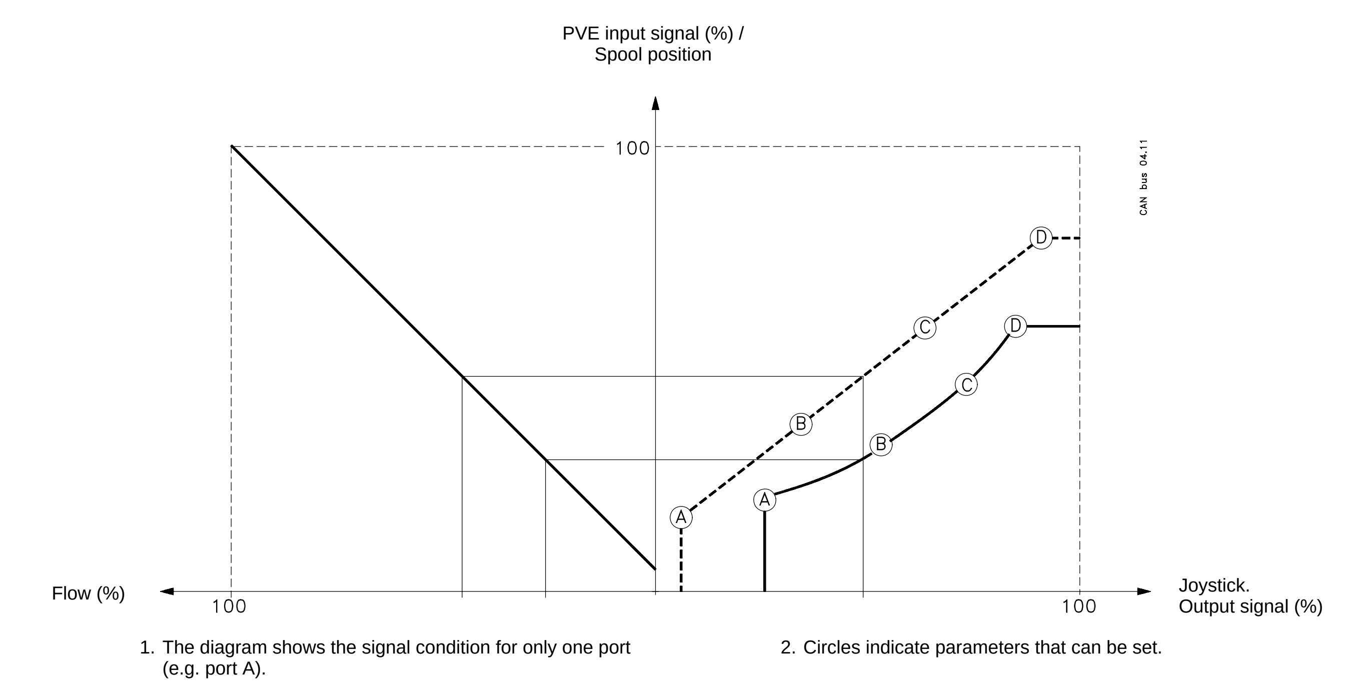
Note: On/off and proportional signals must not be mixed.

Hydraulic-related parameters

PVG CIP contains many parameters that can be adjusted to optimise the input signal before it is sent to a PVE.
These parameters are:

- Deadband compensation
- Signal gain
- Flow limitation
- Software tuning of spool characteristics
- Ramps (individual on each port and two different settings for each port)
- Float position control
- Power saving

The purpose of tuning spool characteristics is to allow software modification of the mechanical spool characteristics made available by the selected spool. See figure on next page. On a given joystick movement, the different software characteristics will give a different spool position and thereby produce another flow.



1. The diagram shows the signal condition for only one port (e.g. port A).
2. Circles indicate parameters that can be set.

The above diagram shows all functions in connection with one port, using four points A, B, C, and D. Points A and D define the limits of the graph and thus the range of the functions that transform a joystick signal to a PVE output in the PVG CIP which then controls the position of the spool in the valve accordingly.

A : Defines deadband compensation and initial flow.

B, C : Defines software tuning of the spool characteristics. Coordinates for B and C are specified to suit the graph and must be scaled every time A and D are changed. This means that seen from points B and C, A always corresponds to (0,0) and D always to (100,100).

D : Defines joystick gain and flow limitation.

Deadband compensation (point A)

This function compensates for the deadband in the PVG spool. The parameters specify a set of coordinates and linear interpolation is performed from (joystick signal, 0) to the function when the deadband compensation is worked out. The function cannot be used in connection with on/off signals.

Joystick signal, PVG CIP output signal

Units	[x, y]: [%,%]
Max.	(100, 100)
Min.	(0,0)
Standard	(0,0)
Precision	(1,1)
OD index	2000 HEX port A x-coordinate
	2001 HEX port A y-coordinate
	2002 HEX port B x-coordinate
	2003 HEX port B y-coordinate

Signal gain (value D_x)

The joystick signal can be scaled with this function. The function cannot be used in connection with on/off signals.

Note: 100% corresponds to normal amplification. Lower figures give larger amplification.

Units [%]	
Max.	100
Min.	25
Standard	100
Precision	1
OD index	2004 HEX port A
	2005 HEX port B

Flow limitation (value D_y)

This function limits the PVE output signal and thereby valve flow. The parameter is specified in percentage since the mechanical characteristics of the PVG CIP spool are not known. The function cannot be used in connection with on/off signals.

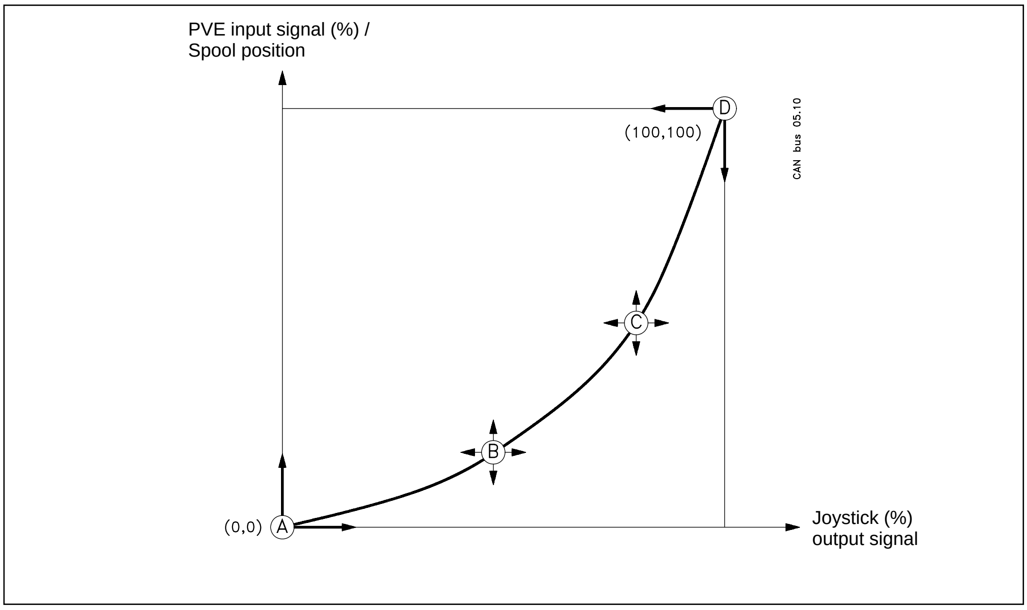
Units	[%]
Max.	100
Min.	Ay (from deadband compensation)
Standard	100
Precision	1
OD index	2006 HEX port A
	2007 HEX port B

Software tuning of spool characteristics (points B, C)

Used to change spool characteristics. This means that the spool need not be changed when only minor changes are necessary. The spool characteristics obtained are limited by its physical characteristics. The function cannot be used in connection with on/off signals.

Note: Points B and C are specified to suit A and D which always represent (0,0) and (100,100) for this function.

On the basis of the two coordinate sets B and C, the best approximated curve through these points is drawn in. Depending on the position of the points, the curve is either a second-order or third-order polynomial.



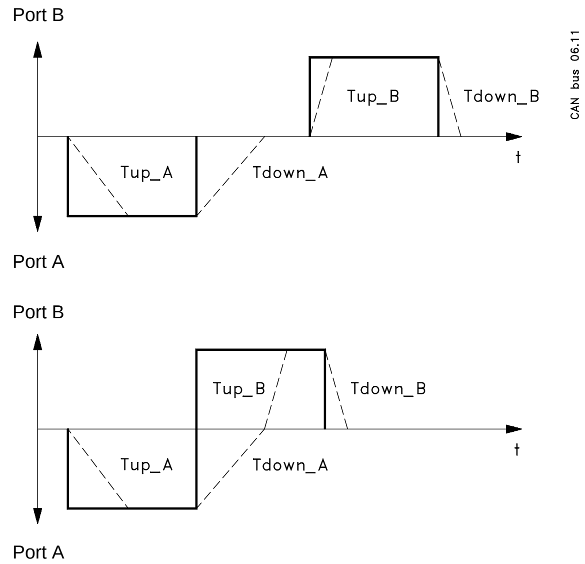
Units	1: (Bxx, Byy)
	2: (Cxx, Cyy)
Max.	(Bx, By) = (100, 100)
	(Cx, Cy) = (100, 100)
Min.	(Bx, By) = (0,0)
	(Cx, Cy) = (0,0)
Standard	1: (33,33)
	2: (66, 66)
OD index	2008 HEX (Bx_ port A)
	2009 HEX (By_ port B)
	200A HEX (Cx_ port A)
	200B HEX (Cy_ port A)
	200C HEX (Bx_ port B)
	200D HEX (By_ port B)
	200E HEX (Cx_ port B)
	200F HEX (Cy_ port B)

Ramps

After signal tuning of points A-D as specified in the previous figure, the signal follows the ramp that is specified here. Two sets of ramps are available for each PVE output (see figure below). Both work on ramp principle 1, familiar in the EHR modules. Fast operation can be obtained by setting Tdown_A and Tdown_B on zero. The function cannot be used in con-nec-tion with on/off signals.

Port A (Tup_A, Tdown_ A)
Port B (Tup_B, Tdown_ B)

Units	[ms]
Max.	(5000, 5000)
Min.	(0,0)
Standard	(0,0)
Precision	1
OD index	2010 HEX (Ramp1 Tup_port A)
	2011 HEX (Ramp1 Tdown_port A)
	2012 HEX (Ramp1 Tup_port B)
	2013 HEX (Ramp1 Tdown_port B)
	2014 HEX (Ramp2 Tup_port A)
	2015 HEX (Ramp2 Tdown_port A)
	2016 HEX (Ramp2 Tup_port B)
	2017 HEX (Ramp2 Tdown_port B)



Ramp switch

Used to select the active ramp setting for a PVG CIP output.

Units	-
	The ramp switch can be set in four ways: 0: No ramps 1: Ramp 1 used permanently 2: Ramp 2 used permanently [ ]: Switch between ramp 1 and ramp 2 using an on/off signal. If this is the case, the address of the on/off (OD index 2100-2103) must be entered in this field.
Max.	3 sec.
Min.	0
Standard	0
Precision	1
OD index	2019 HEX

Float position control function

The float position control function makes it possible to connect ports A and B to tank. This is performed mechanically by a specially designed spool. Two steps are necessary to activate the function:

1. The proportional function connected to the float position control function must be established.

OD index	2104 HEX

The signal for the float position PVE must be activated say more than x% in the direction of port B.

Units	[%]-
Max.	100
Min.	10
Standard	10
Precision	1
OD index	201D HEX

The function can be deactivated in two ways:

- If the joystick is moved towards port A by a signal of more than 10%.
- If the joystick is within 10% signal to both ports A and B and the button is activated.

2. The button used to activate the float position is mapped.

OD index	2105 HEX

Power save time

Defines the time delay from inactivity (PVE signal = neutral) until power to the PVEs is cut off (individually).

Units	[s]
Max.	20
Min.	0 (not connected)
Standard	0
Precision	1
OD index	201C HEX

Fault location/service parameters

The following functions are provided to enable servicing and fault location on PVG CIP:

- Activation of PVE
- Diagnosing
- Restoring factory settings

Enable PVE

This function is used for servicing. It activates or deactivates individual PVE signals, i.e. when the function is deactivated, a neutral signal is sent to the PVE irrespective of the received CAN message.

Units	-
Max.	1 (activated)
Min.	0 (deactivated)
Standard	1
Precision	1
OD index	201B HEX

Diagnosing

When diagnosing it is possible to see the last 25 faults and their types. See fault types under “Safety aspects”, page 9.

Note: The value 0 signifies no fault.

OD index	1003 HEX

Restoring factory settings

Factory settings of all accessible parameters are stored permanently in PVG CIP. This function is used to restore all parameter settings to “Factory standard” by overwriting the existing parameter settings.
Restoring can be performed at several levels by writing a signature “LOAD” in reverse order to the respective subindexes:

- All parameters
- Communication parameters
  - Node ID
  - Baudrate
- Functions
- Connection between Prof 1 CIP and PVG CIP

Units	-
DOAL	64616F6C HEX
Standard	-
Precision	1
OD index	1011 HEX

Introduction to Prof 1 CIP

This component is based on the Prof 1 joystick and can therefore be set up for many mechanical configurations. The joystick also contains other functions often used on the hydraulics market. The associated parameters can be set in the OD (see page 29) either using the CIP Configuration Tool or standard CANopen configuration tools.

Setting up Prof 1 CIP can be divided into four main parts:

1) Setting up the mechanical Prof 1 CIP

2) Setting up hydraulic-related parameters
   a) Guide function
   b) Memory

3) Setting system-related parameters
   a) Baudrate setting
   b) Node identification
   c) Cyclic trigger
   d) Node guarding

4) Fault location and servicing
   a) Restoring factory settings
   b) Diagnosing

Setting up the mechanical Prof 1 CIP

The Prof 1 joystick is available in many mechanical configurations. To simplify the way in which this can be represented in the COB, the maximum configuration is always sent. This means that four proportional and six on/off signals are packed in one COB. Depending on the actual configuration of the joystick, some of the fields for proportional and/or on/off signals carry no information. For the same reason it is not necessary to make any adjustments from joystick to joystick because of different mechanical setups.

Setting up hydraulic-related parameters

Prof 1 CIP also contains functions that are often used in hydraulic systems:

- Joystick guide function. This function prioritises the main axis in the joystick by giving first priority to the axis activated first.

Joystick gate function

Units	-
Max.	1 (function activated)
Min.	0 (function deactivated)
Standard	0
Precision	1
OD index	3002 HEX

- The memory function makes it possible for the user to set the joystick so that it trans fers a proportional signal to the bus even though the joystick is in neutral.
  The proportional signal can be maintained deleted from the memory by pressing a button. This button and the proportional function can be mapped in:

OD index	3007 HEX

The function can be activated/deactivated in:

Units	-
Max.	1 (function activated)
Min.	0 (function deactivated)
Standard	0
Precision	1
OD index	3004 HEX

System-related parameters

To be able to set up and service Prof 1 CIP, the following system-related parameters must be adjusted:

- Baudrate
- Node identification
- Cyclic trigger
- Node guarding

Baudrate

The communication speed must be set. The baudrate comes into effect after system reboot.

Note: The baudrates 10 and 800 are not supported by CIP Configuration Tool v.1.00.

Units	[kbit/s]
Max.	1000
Min.	10
Standard	250
Precision	*
OD index	3000 HEX

* 10, 20, 50, 100, 125, 250, 500, 800, 1000.

Node identification

Node identification specifies which address Prof 1 CIP has.

Units	-
Max.	127
Min.	1
Standard	100
Precision	1
OD index	100B HEX

Cyclic trigger

The joystick sends information on the first PDO (tx). As standard, the joystick transfers cyclically using T_c = 10 ms. NMT is used if a fault arises in the joystick. The NMT object is a standard emergency object in CANopen.

Units	[ms]
Max.	200
Min.	10
Standard	10
Precision	1
OD index	3005 HEX

Node guarding

Used in minimum systems where Prof 1 CIP is master. The function checks whether all components/nodes (max. 20) on the bus work. If they do not, the components involved receive a reset on their Node ID via the CAN bus.

Units	Node ID
Max.	127
Min.	0
Standard	0
Precision	1
OD index	3008 HEX subindex 1-20

Fault location/service parameters

The following functions are provided in Prof 1 CIP for servicing and fault location:

- Diagnosing
- Restoring factory settings

Diagnosing

Here, it is possible to see the last ten faults and their type (see page 9).

Note: The value 0 signifies no fault.

OD index	1003 HEX

Restoring factory settings

Factory settings of all accessible parameters are stored permanently in Prof 1 CIP. This function is used to re-establish all parameter settings to “Factory standard” by overwriting the existing parameter settings.
Re-establishment can be performed at several levels by writing a signature “LOAD” in reverse order to the respective subindexes:

- All parameters
- Communication parameters
  - Node ID
  - Baudrate
- Functions and connections between Prof 1 CIP and PVG CIP

Units	-
DOAL	64616F6C HEX
Min.	0 (deactivated)
Standard	-
Precision	1
OD index	1011 HEX

Introduction to CIP Configuration Tool

This program pack offers the user several different programs for meeting various requirements:

CIP Configuration Tool
Setting up a system consisting exclusively of PVG CIP and Prof 1 CIP via a graphical user interface. It takes the user through setting up a system in an easily understandable and instructive way. It cannot set up components from a third party. However, the hydraulic parameters in PVG CIP and Prof 1 CIP can be adjusted with advantage even though CAN components from a third party are involved.

CIP Downloading Utility
This program enables the adjustment of CANopen parameters on all CANopen components, direct in the OD (see example on page 21).

CANview
CANview is a program able to read the activity taking place on the bus. It is therefore a tool that can be used in servicing.

The program pack also contains a dongle (PEAK) which is the interface between the PC and CAN bus.

P.S. We recommend the use of PEAK's dongle in connection with our software.

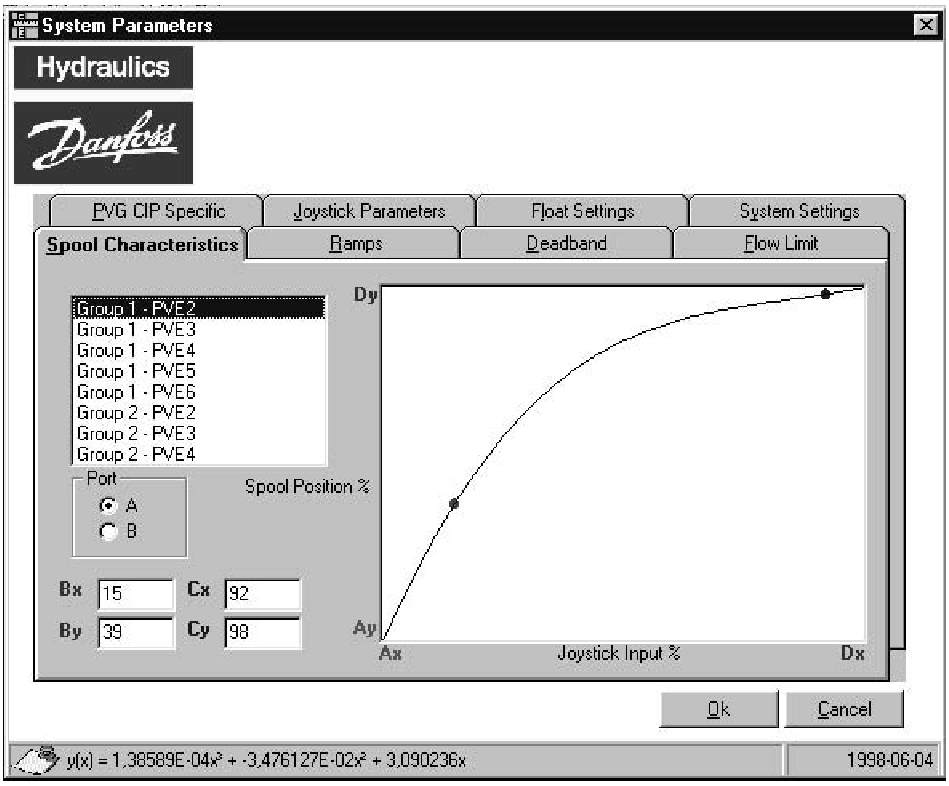
System requirements

- Windows 95 or higher
- Recommended Pentium microprocessor (or higher)
- 16 Mb RAM (recommended)
- PEAK dongle (CAN communication interface)
- PS/2 mouse port

Installation of CIP Configuration Tool

To install a CIP Configuration Tool:

1. Insert the CD-ROM in the CD-ROM drive.
2. From Start, select Run and write x:\setup.exe (where x is the CD-ROM drive).
3. Follow the displayed instructions.



Example of system setup via CIP Downloading Utility

This is an example of setting up the parameters in connecting a Prof 1 CIP joystick with a PVG CIP. The example is divided into steps:

Step 1: Connection of PDOs
Step 2: Setup of PVE types
Step 3: Connections between Prof 1 CIP and PVG CIP outputs

The example is based on the following requirements:

PVG group

Output	Type
1	PVEH
2	PVEO
3	PVEH float position control
4	N/A
5	N/A
6	N/A
7	N/A
8	N/A

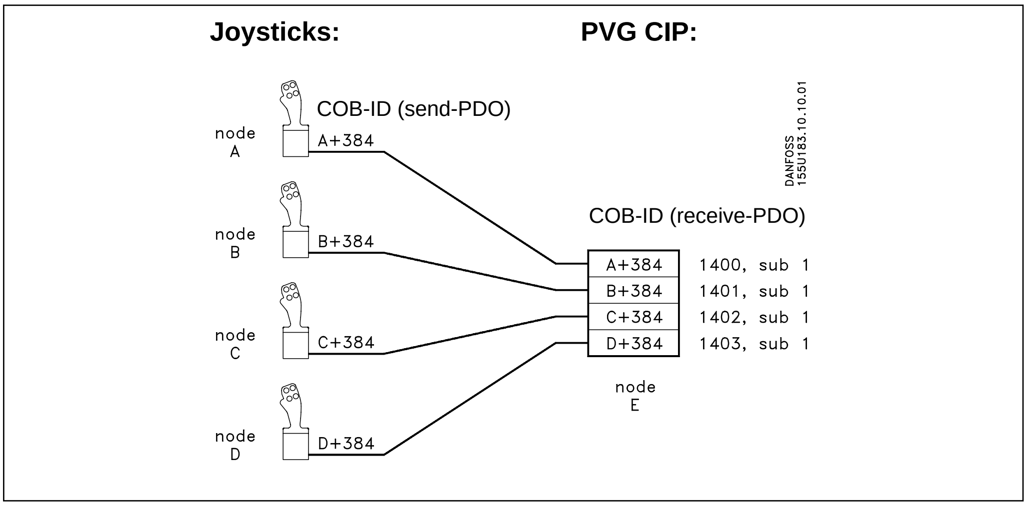
Connection

Prof 1 CIP	PVG CIP
Plug 1	PVE 1
Push 3A	PVE 2 port A
Push 4A	PVE 2 port B
Plug 2	PVE 3 (inverted)
Push 5	PVE 3 (float position (control activated)

Stage 1: Connection of PDOs

To be able to send information between Prof 1 CIP and PVG CIP components, the Prof 1 CIP send-PDO and PVG CIP receive-PDO match each other. Since both comply with the CAN-open standard, the connection must be established by the system designer.

There is a connection between the joystick node ID and the corresponding COB-ID. It is used to send and receive PDOs and is made up as follows:

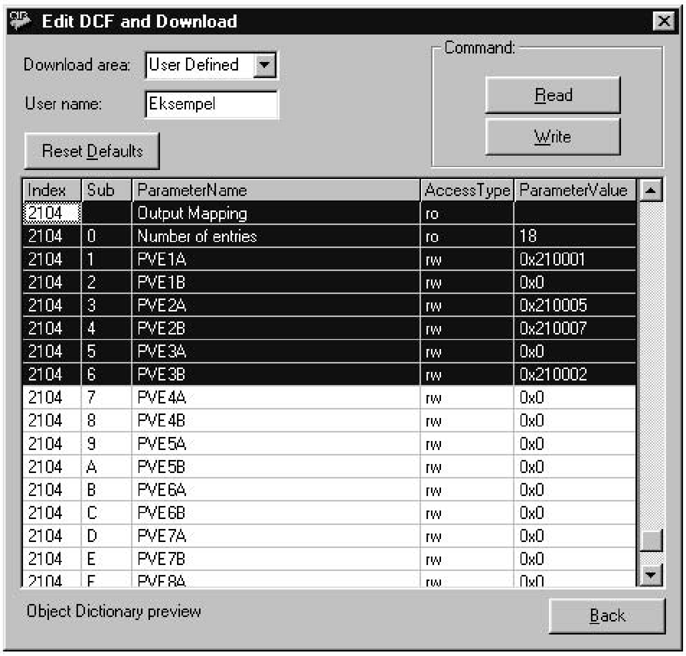


Since the standard ID of Prof 1 CIP is 100, the corresponding send-PDO uses COB-ID: 100+384d = 484d

To connect the PVG CIP to the COB-ID of a Prof 1 CIP it is also necessary to change the PVG CIP receive-PDO to 484d.

This is done by changing the index 1400 HEX, Subindex 1 = 484d, where d states that the figure is decimal.

1400, sub 1



Step 2:
Setting up PVE types

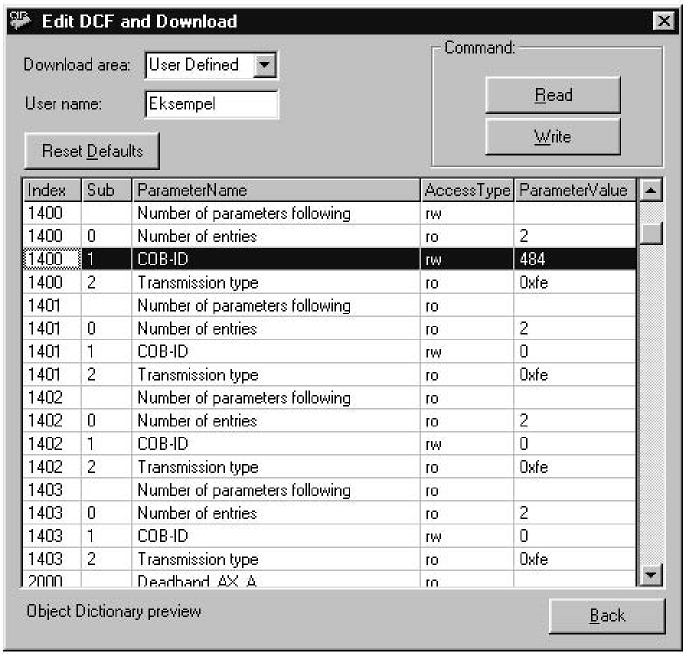
PVE (PVEM/H/S) types are used to select the PVG CIP control function. The types are defined in Index 2018, subindex 1-8 (see page 27).

Applicable PVE types:

Not accessible	0
PVEO	1
PVEM	2
PVEH/S	3
PVEM (float position control)	4
PVEH (float position control)	5

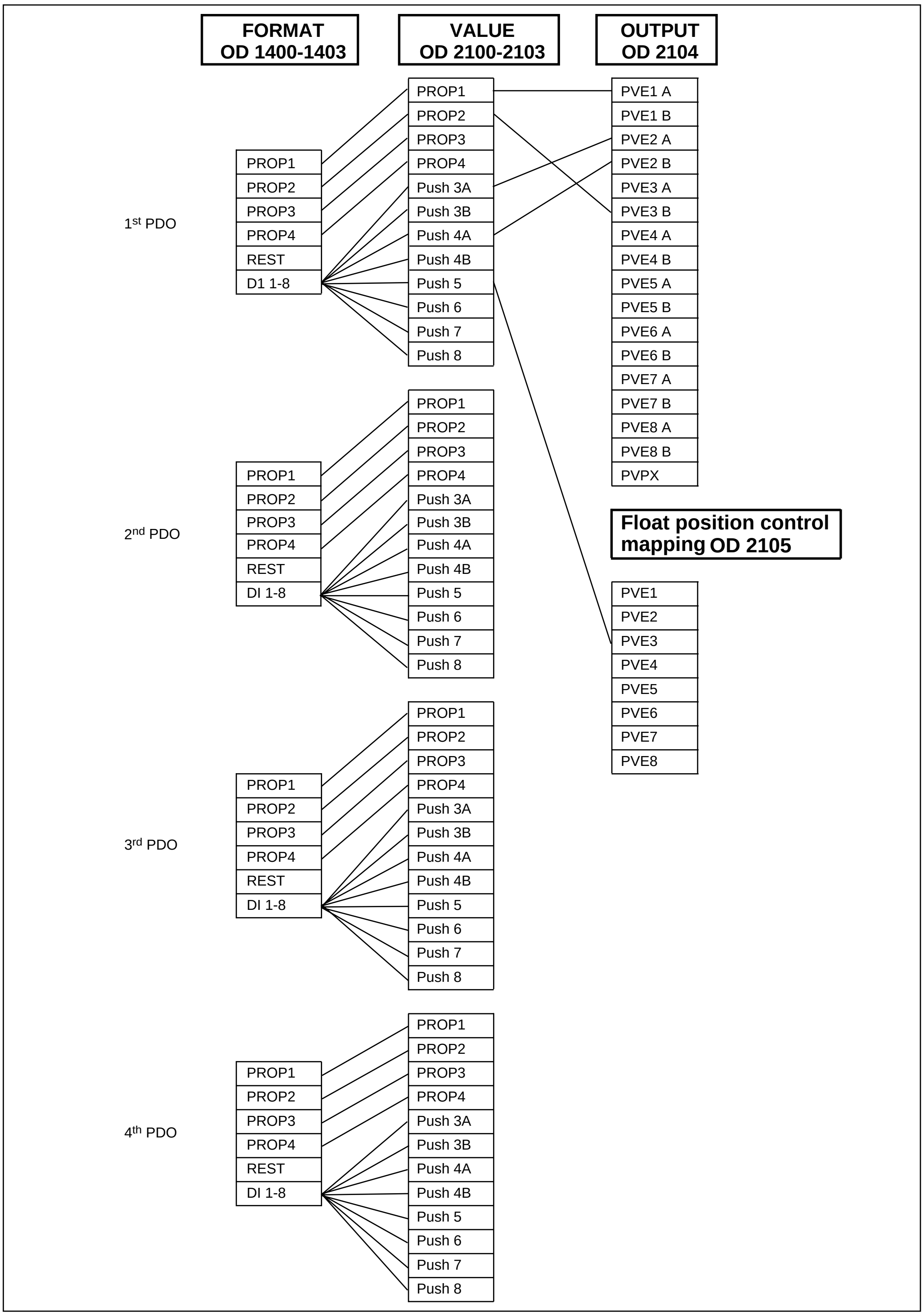
In this example the following changes have:

Screen dump of type setup



Step 3:
Connecting joystick signals to PVE outputs

Connections between inputs and outputs in PVG CIP are made as follows:

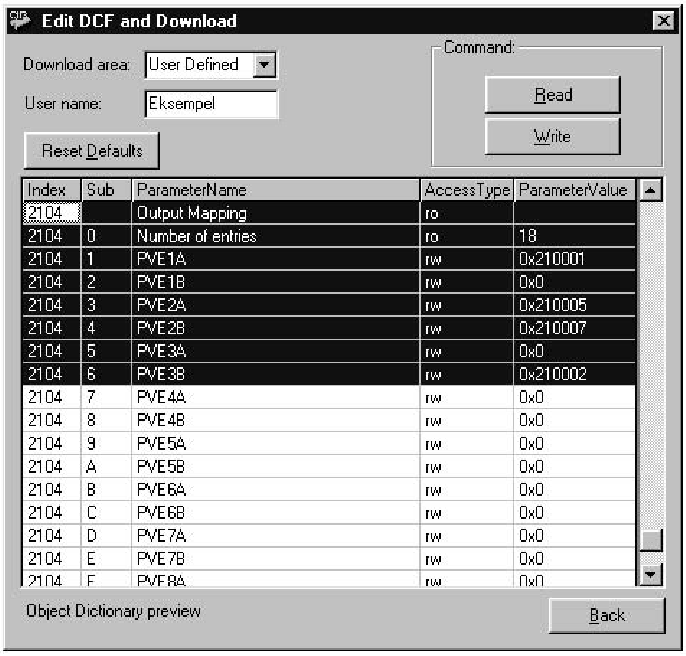


In the PVG CIP OD the inputs have indexes 1400-1403. In this OD range only the format of incoming message is shown, not the values. The values of incoming joystick signals can be read from the index range 2100-2103.

	Index for changing COB-ID, see step 1	Index from which values can be read
1st PDO	1400, sub 1	2100, sub 1-C
2nd PDO	1401, sub 1	2101, sub 1-C
3rd PDO	1402, sub 1	2102, sub 1-C
4th PDO	1403, sub 1	2103, sub 1-C

PVG CIP inputs can be connected with Prof 1 CIP outputs by writing the corresponding value index in the PVG CIP input mapping structure.

This means that in this example we must make the following connections in PVG CIP OD index 2104 HEX.



Edit DCF and Download

Download area: User Defined

User name: Eksempel

Reset Defaults

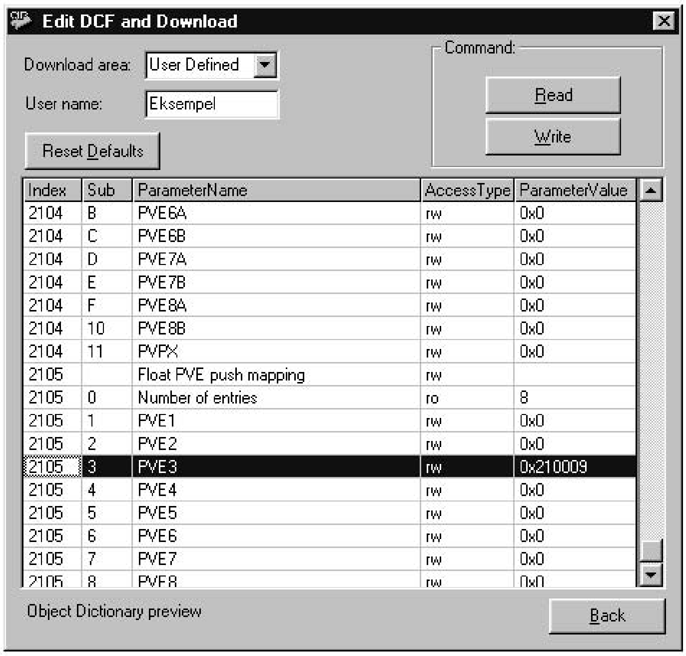
Command: Read Write

Index	Sub	ParameterName	AccessType	ParameterValue
2104		Output Mapping	ro	
2104	0	Number of entries	ro	18
2104	1	PVE1A	rw	0x210001
2104	2	PVE1B	rw	0x0
2104	3	PVE2A	rw	0x210005
2104	4	PVE2B	rw	0x210007
2104	5	PVE3A	rw	0x0
2104	6	PVE3B	rw	0x210002
2104	7	PVE4A	rw	0x0
2104	8	PVE4B	rw	0x0
2104	9	PVE5A	rw	0x0
2104	A	PVE5B	rw	0x0
2104	B	PVE6A	rw	0x0
2104	C	PVE6B	rw	0x0
2104	D	PVE7A	rw	0x0
2104	E	PVE7B	rw	0x0
2104	F	PVE8A	rw	0x0

Object Dictionary preview

Back

*)



Edit DCF and Download

Download area: User Defined

User name: Eksempel

Reset Defaults

Command: Read Write

Index	Sub	ParameterName	AccessType	ParameterValue
2104	B	PVE6A	rw	0x0
2104	C	PVE6B	rw	0x0
2104	D	PVE7A	rw	0x0
2104	E	PVE7B	rw	0x0
2104	F	PVE8A	rw	0x0
2104	10	PVE8B	rw	0x0
2104	11	PVPX	rw	0x0
2105		Float PVE push mapping	rw	
2105	0	Number of entries	ro	8
2105	1	PVE1	rw	0x0
2105	2	PVE2	rw	0x0
2105	3	PVE3	rw	0x210009
2105	4	PVE4	rw	0x0
2105	5	PVE5	rw	0x0
2105	6	PVE6	rw	0x0
2105	7	PVE7	rw	0x0
2105	8	PVE8	rw	0x0

Object Dictionary preview

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***) Note:** If a proportional signal is connected to, for example, PVE 3 B instead of A, the signal becomes inverted.

Parameter list 1 of 5 for PVG CIP (shortened version of OD)

Index	Subindex	Parameter Name
1000		Device Type
1001		Error Register
1003		error field
1003	0	Number of errors
1003	1	Standard error code
1004		Number of PDOs supported
1004	0	Number of PDOs supported
1004	1	Number of synchronous PDOs
1004	2	Number of asynchronous PDOs
1008		Manufaturer Device Name
1009		Hardware Version
100A		Software Version
100B		Node-ID
100C		Guard Time
100D		Life time factor
100E		Node guarding ID
1011		Restore parameters
1011	0	Largest supported sub-index
1011	1	Restore all default parameters
1011	2	Restore communication default parameters
1011	4	Restore default function settings
1011	5	Restore default output mapping
1400		Number of parameters following
1400	0	Number of entries
1400	1	COB-ID
1400	2	Transmission type
1401		Number of parameters following
1401	0	Number of entries
1401	1	COB-ID
1401	2	Transmission type
1402		Number of parameters following
1402	0	Number of entries
1402	1	COB-ID
1402	2	Transmission type
1403		Number of parameters following
1403	0	Number of entries
1403	1	COB-ID
1403	2	Transmission type
1600		Input values PDO1 index 1600
1600	0	Number of entries
1600	1	Prop1
1600	2	Prop2
1600	3	Prop3
1600	4	Prop4
1600	5	Rest
1600	6	Push3A
1600	7	Push3B
1600	8	Push4A
1600	9	Push4B
1600	A	Push5
1600	B	Push6
1600	C	Push7
1600	D	Push8
1601		Input values PDO2 index 1601
1601	0	Number of entries
1601	1	Prop1
1601	2	Prop2
1601	3	Prop3
1601	4	Prop4
1601	5	Rest
1601	6	Push3A
1601	7	Push3B
1601	8	Push4A
1601	9	Push4B
1601	A	Push5
1601	B	Push6
1601	C	Push7
1601	D	Push8
1602		Input values PDO3 index 1602
1602	0	Number of entries
1602	1	Prop1
1602	2	Prop2
1602	3	Prop3
1602	4	Prop4
1602	5	Rest
1602	6	Push3A
1602	7	Push3B
1602	8	Push4A
1602	9	Push4B
1602	A	Push5
1602	B	Push6
1602	C	Push7
1602	D	Push8
1603		Input values PDO4 index 1603
1603	0	Number of entries
1603	1	Prop1
1603	2	Prop2
1603	3	Prop3
1603	4	Prop4
1603	5	Rest
1603	6	Push3A
1603	7	Push3B
1603	8	Push4A
1603	9	Push4B
1603	A	Push5
1603	B	Push6
1603	C	Push7
1603	D	Push8
2000		Deadband_AX_A
2000	0	Number of PVEs
2000	1	DBC_1_AX_A
2000	2	DBC_2_AX_A
2000	3	DBC_3_AX_A
2000	4	DBC_4_AX_A
2000	5	DBC_5_AX_A
2000	6	DBC_6_AX_A
2000	7	DBC_7_AX_A
2000	8	DBC_8_AX_A
2001		Deadband_AY_A
2001	0	Number of PVEs
2001	1	DBC_1_AY_A
2001	2	DBC_2_AY_A
2001	3	DBC_3_AY_A
2001	4	DBC_4_AY_A
2001	5	DBC_5_AY_A

Parameter list 2 of 5 for PVG CIP (shortened version of OD)

Index	Subindex	Parameter Name
2001	6	DBC_6_AY_A
2001	7	DBC_7_AY_A
2001	8	DBC_8_AY_A
2002		Deadband_AX_B
2002	0	Number of PVEs
2002	1	DBC_1_AX_B
2002	2	DBC_2_AX_B
2002	3	DBC_3_AX_B
2002	4	DBC_4_AX_B
2002	5	DBC_5_AX_B
2002	6	DBC_6_AX_B
2002	7	DBC_7_AX_B
2002	8	DBC_8_AX_B
2003		Deadband_AY_B
2003	0	Number of PVEs
2003	1	DBC_1_AY_B
2003	2	DBC_2_AY_B
2003	3	DBC_3_AY_B
2003	4	DBC_4_AY_B
2003	5	DBC_5_AY_B
2003	6	DBC_6_AY_B
2003	7	DBC_7_AY_B
2003	8	DBC_8_AY_B
2004		GAIN
2004	0	Number of PVEs
2004	1	GAIN_1_DX_A
2004	2	GAIN_2_DX_A
2004	3	GAIN_3_DX_A
2004	4	GAIN_4_DX_A
2004	5	GAIN_5_DX_A
2004	6	GAIN_6_DX_A
2004	7	GAIN_7_DX_A
2004	8	GAIN_8_DX_A
2005		GAIN_DX_B
2005	0	Number of PVEs
2005	1	GAIN_1_DX_B
2005	2	GAIN_2_DX_B
2005	3	GAIN_3_DX_B
2005	4	GAIN_4_DX_B
2005	5	GAIN_5_DX_B
2005	6	GAIN_6_DX_B
2005	7	GAIN_7_DX_B
2005	8	GAIN_8_DX_B
2006		Flow Limit
2006	0	Number of PVEs
2006	1	FLOW LIMIT_1_DY_A
2006	2	FLOW LIMIT_2_DY_A
2006	3	FLOW LIMIT_3_DY_A
2006	4	FLOW LIMIT_4_DY_A
2006	5	FLOW LIMIT_5_DY_A
2006	6	FLOW LIMIT_6_DY_A
2006	7	FLOW LIMIT_7_DY_A
2006	8	FLOW LIMIT_8_DY_A
2007		FLOW LIMIT
2007	0	Number of PVEs
2007	1	FLOW LIMIT_1_DY_B
2007	2	FLOW LIMIT_2_DY_B
2007	3	FLOW LIMIT_3_DY_B

Index	Subindex	Parameter Name
2007	4	FLOW LIMIT_4_DY_B
2007	5	FLOW LIMIT_5_DY_B
2007	6	FLOW LIMIT_6_DY_B
2007	7	FLOW LIMIT_7_DY_B
2007	8	FLOW LIMIT_8_DY_B
2008		SW TUNE BX A
2008	0	Number of PVEs
2008	1	SW TUNE_1_BX_A
2008	2	SW TUNE_2_BX_A
2008	3	SW TUNE_3_BX_A
2008	4	SW TUNE_4_BX_A
2008	5	SW TUNE_5_BX_A
2008	6	SW TUNE_6_BX_A
2008	7	SW TUNE_7_BX_A
2008	8	SW TUNE_8_BX_A
2009		SW TUNE BY A
2009	0	Number of PVEs
2009	1	SW TUNE_1_BY_A
2009	2	SW TUNE_2_BY_A
2009	3	SW TUNE_3_BY_A
2009	4	SW TUNE_4_BY_A
2009	5	SW TUNE_5_BY_A
2009	6	SW TUNE_6_BY_A
2009	7	SW TUNE_7_BY_A
2009	8	SW TUNE_8_BY_A
200A		SW TUNE CX A
200A	0	Number of PVEs
200A	1	SW TUNE_1_CX_A
200A	2	SW TUNE_2_CX_A
200A	3	SW TUNE_3_CX_A
200A	4	SW TUNE_4_CX_A
200A	5	SW TUNE_5_CX_A
200A	6	SW TUNE_6_CX_A
200A	7	SW TUNE_7_CX_A
200A	8	SW TUNE_8_CX_A
200B		SW TUNE CY A
200B	0	Number of PVEs
200B	1	SW TUNE_1_CY_A
200B	2	SW TUNE_2_CY_A
200B	3	SW TUNE_3_CY_A
200B	4	SW TUNE_4_CY_A
200B	5	SW TUNE_5_CY_A
200B	6	SW TUNE_6_CY_A
200B	7	SW TUNE_7_CY_A
200B	8	SW TUNE_8_CY_A
200C		SW TUNE BX B
200C	0	Number of PVEs
200C	1	SW TUNE_1_BX_B
200C	2	SW TUNE_2_BX_B
200C	3	SW TUNE_3_BX_B
200C	4	SW TUNE_4_BX_B
200C	5	SW TUNE_5_BX_B
200C	6	SW TUNE_6_BX_B
200C	7	SW TUNE_7_BX_B
200C	8	SW TUNE_8_BX_B
200D		SW TUNE BY B
200D	0	Number of PVEs
200D	1	SW TUNE_1_BY_B

Parameter list 3 of 5 for PVG CIP (shortened version of OD)

Index	Subindex	Parameter Name
200D	2	SW TUNE_2_BY_B
200D	3	SW TUNE_3_BY_B
200D	4	SW TUNE_4_BY_B
200D	5	SW TUNE_5_BY_B
200D	6	SW TUNE_6_BY_B
200D	7	SW TUNE_7_BY_B
200D	8	SW TUNE_8_BY_B
200E		SW TUNE CX B
200E	0	Number of PVEs
200E	1	SW TUNE_1_CX_B
200E	2	SW TUNE_2_CX_B
200E	3	SW TUNE_3_CX_B
200E	4	SW TUNE_4_CX_B
200E	5	SW TUNE_5_CX_B
200E	6	SW TUNE_6_CX_B
200E	7	SW TUNE_7_CX_B
200E	8	SW TUNE_8_CX_B
200F		SW TUNE CY B
200F	0	Number of PVEs
200F	1	SW TUNE_1_CY_B
200F	2	SW TUNE_2_CY_B
200F	3	SW TUNE_3_CY_B
200F	4	SW TUNE_4_CY_B
200F	5	SW TUNE_5_CY_B
200F	6	SW TUNE_6_CY_B
200F	7	SW TUNE_7_CY_B
200F	8	SW TUNE_8_CY_B
2010		RAMP1_TUP_A
2010	0	Number of PVEs
2010	1	RAMP1_1_TUP_A
2010	2	RAMP1_2_TUP_A
2010	3	RAMP1_3_TUP_A
2010	4	RAMP1_4_TUP_A
2010	5	RAMP1_5_TUP_A
2010	6	RAMP1_6_TUP_A
2010	7	RAMP1_7_TUP_A
2010	8	RAMP1_8_TUP_A
2011		RAMP1 TDOWN A
2011	0	Number of PVEs
2011	1	RAMP1_1_TDOWN_A
2011	2	RAMP1_2_TDOWN_A
2011	3	RAMP1_3_TDOWN_A
2011	4	RAMP1_4_TDOWN_A
2011	5	RAMP1_5_TDOWN_A
2011	6	RAMP1_6_TDOWN_A
2011	7	RAMP1_7_TDOWN_A
2011	8	RAMP1_8_TDOWN_A
2012		RAMP1 TUP B
2012	0	Number of PVEs
2012	1	RAMP1_1_TUP_B
2012	2	RAMP1_2_TUP_B
2012	3	RAMP1_3_TUP_B
2012	4	RAMP1_4_TUP_B
2012	5	RAMP1_5_TUP_B
2012	6	RAMP1_6_TUP_B
2012	7	RAMP1_7_TUP_B
2012	8	RAMP1_8_TUP_B
2013		RAMP1 TDOWN B

Index	Subindex	Parameter Name
2013	0	Number of PVEs
2013	1	RAMP1_1_TDOWN_B
2013	2	RAMP1_2_TDOWN_B
2013	3	RAMP1_3_TDOWN_B
2013	4	RAMP1_4_TDOWN_B
2013	5	RAMP1_5_TDOWN_B
2013	6	RAMP1_6_TDOWN_B
2013	7	RAMP1_7_TDOWN_B
2013	8	RAMP1_8_TDOWN_B
2014		RAMP2 TUP A
2014	0	Number of PVE's
2014	1	RAMP2_1_TUP_A
2014	2	RAMP2_2_TUP_A
2014	3	RAMP2_3_TUP_A
2014	4	RAMP2_4_TUP_A
2014	5	RAMP2_5_TUP_A
2014	6	RAMP2_6_TUP_A
2014	7	RAMP2_7_TUP_A
2014	8	RAMP2_8_TUP_A
2015		RAMP2 TDOWN A
2015	0	Number of PVEs
2015	1	RAMP2_1_TDOWN_A
2015	2	RAMP2_2_TDOWN_A
2015	3	RAMP2_3_TDOWN_A
2015	4	RAMP2_4_TDOWN_A
2015	5	RAMP2_5_TDOWN_A
2015	6	RAMP2_6_TDOWN_A
2015	7	RAMP2_7_TDOWN_A
2015	8	RAMP2_8_TDOWN_A
2016		RAMP2 TUP B
2016	0	Number of PVEs
2016	1	RAMP2_1_TUP_B
2016	2	RAMP2_2_TUP_B
2016	3	RAMP2_3_TUP_B
2016	4	RAMP2_4_TUP_B
2016	5	RAMP2_5_TUP_B
2016	6	RAMP2_6_TUP_B
2016	7	RAMP2_7_TUP_B
2016	8	RAMP2_8_TUP_B
2017		RAMP2 TDOWN B
2017	0	Number of PVEs
2017	1	RAMP2_1_TDOWN_B
2017	2	RAMP2_2_TDOWN_B
2017	3	RAMP2_3_TDOWN_B
2017	4	RAMP2_4_TDOWN_B
2017	5	RAMP2_5_TDOWN_B
2017	6	RAMP2_6_TDOWN_B
2017	7	RAMP2_7_TDOWN_B
2017	8	RAMP2_8_TDOWN_B
2018		PVE Type Indicator
2018	0	Number of PVEs + PVPX
2018	1	TYPE_1
2018	2	TYPE_2
2018	3	TYPE_3
2018	4	TYPE_4
2018	5	TYPE_5
2018	6	TYPE_6
2018	7	TYPE_7

Parameter list 4 of 5 for PVG CIP (shortened version of OD)

Index	Subindex	Parameter Name
2018	8	TYPE_8
2018	9	PVPX AVAILABLE
2019		RAMP MODE
2019	0	Number of PVEs
2019	1	RAMP MODE_1
2019	2	RAMP MODE_2
2019	3	RAMP MODE_3
2019	4	RAMP MODE_4
2019	5	RAMP MODE_5
2019	6	RAMP MODE_6
2019	7	RAMP MODE_7
2019	8	RAMP MODE_8
201A		Baudrate
201B		ENABLE PVE OUTPUTS
201B	0	Number of PVEs
201B	1	ENABLE_1
201B	2	ENABLE_2
201B	3	ENABLE_3
201B	4	ENABLE_4
201B	5	ENABLE_5
201B	6	ENABLE_6
201B	7	ENABLE_7
201B	8	ENABLE_8
201C		Power saving time
201C	0	Number of PVEs
201C	1	POWER SAVING TIME_1
201C	2	POWER SAVING TIME_2
201C	3	POWER SAVING TIME_3
201C	4	POWER SAVING TIME_4
201C	5	POWER SAVING TIME_5
201C	6	POWER SAVING TIME_6
201C	7	POWER SAVING TIME_7
201C	8	POWER SAVING TIME_8
201D		FLOAT ACTIVATION LEVEL
201D	0	Number of PVEs
201D	1	FLOAT ACTIVATION LEVEL_1
201D	2	FLOAT ACTIVATION LEVEL_2
201D	3	FLOAT ACTIVATION LEVEL_3
201D	4	FLOAT ACTIVATION LEVEL_4
201D	5	FLOAT ACTIVATION LEVEL_5
201D	6	FLOAT ACTIVATION LEVEL_6
201D	7	FLOAT ACTIVATION LEVEL_7
201D	8	FLOAT ACTIVATION LEVEL_8
2100		Input values PDO 1
2100	0	Number of entries
2100	1	Prop1
2100	2	Prop2
2100	3	Prop3
2100	4	Prop4
2100	5	Push3A
2100	6	Push3B
2100	7	Push4A
2100	8	Push4B
2100	9	Push5
2100	A	Push6
2100	B	Push7
2100	C	Push8
2101		Input values PDO 2

Index	Subindex	Parameter Name
2101	0	Number of entries
2101	1	Prop1
2101	2	Prop2
2101	3	Prop3
2101	4	Prop4
2101	5	Push3A
2101	6	Push3B
2101	7	Push4A
2101	8	Push4B
2101	9	Push5
2101	A	Push6
2101	B	Push7
2101	C	Push8
2102		Input values PDO 3
2102	0	Number of entries
2102	1	Prop1
2102	2	Prop2
2102	3	Prop3
2102	4	Prop4
2102	5	Push3A
2102	6	Push3B
2102	7	Push4A
2102	8	Push4B
2102	9	Push5
2102	A	Push6
2102	B	Push7
2102	C	Push8
2103		Input values PDO 4
2103	0	Number of entries
2103	1	Prop1
2103	2	Prop2
2103	3	Prop3
2103	4	Prop4
2103	5	Push3A
2103	6	Push3B
2103	7	Push4A
2103	8	Push4B
2103	9	Push5
2103	A	Push6
2103	B	Push7
2103	C	Push8
2104		Output Mapping
2104	0	Number of entries
2104	1	PVE1A
2104	2	PVE1B
2104	3	PVE2A
2104	4	PVE2B
2104	5	PVE3A
2104	6	PVE3B
2104	7	PVE4A
2104	8	PVE4B
2104	9	PVE5A
2104	A	PVE5B
2104	B	PVE6A
2104	C	PVE6B
2104	D	PVE7A
2104	E	PVE7B
2104	F	PVE8A

Parameter list 5 of 5 for PVG CIP (shortened version of OD)

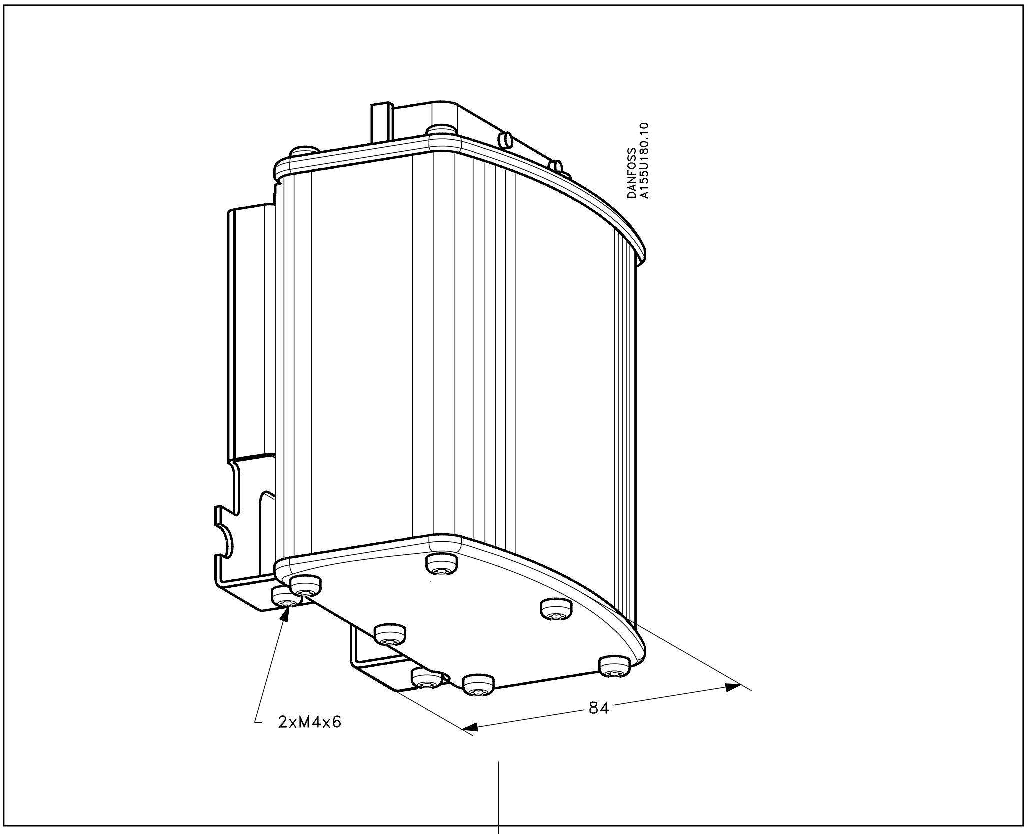
Index	Subindex	Parameter Name
2104	10	PVE8B
2104	11	PVPX
2105		Float PVE push mapping
2105	0	Number of entries
2105	1	PVE1
2105	2	PVE2
2105	3	PVE3
2105	4	PVE4
2105	5	PVE5
2105	6	PVE6
2105	7	PVE7
2105	8	PVE8

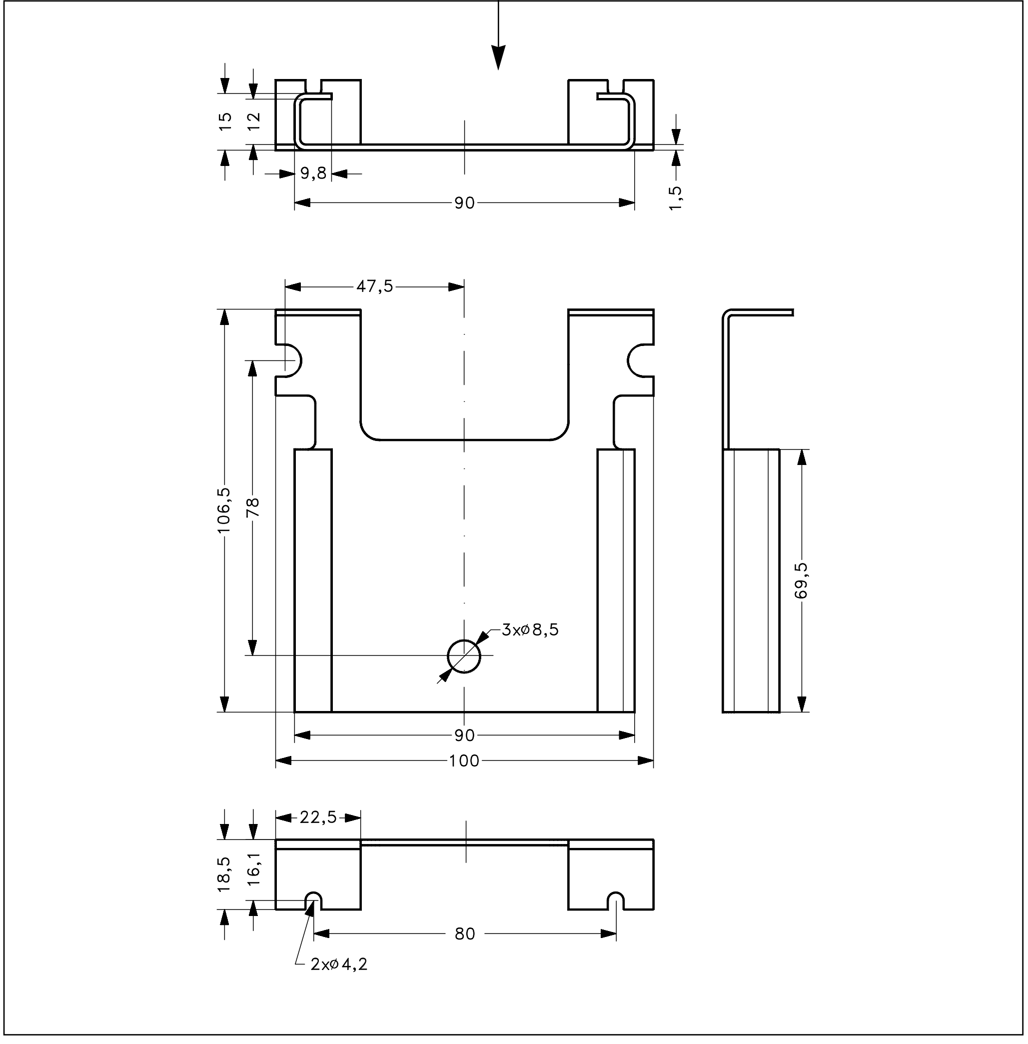
Parameterlist for Prof 1 CIP (shortened version of OD)

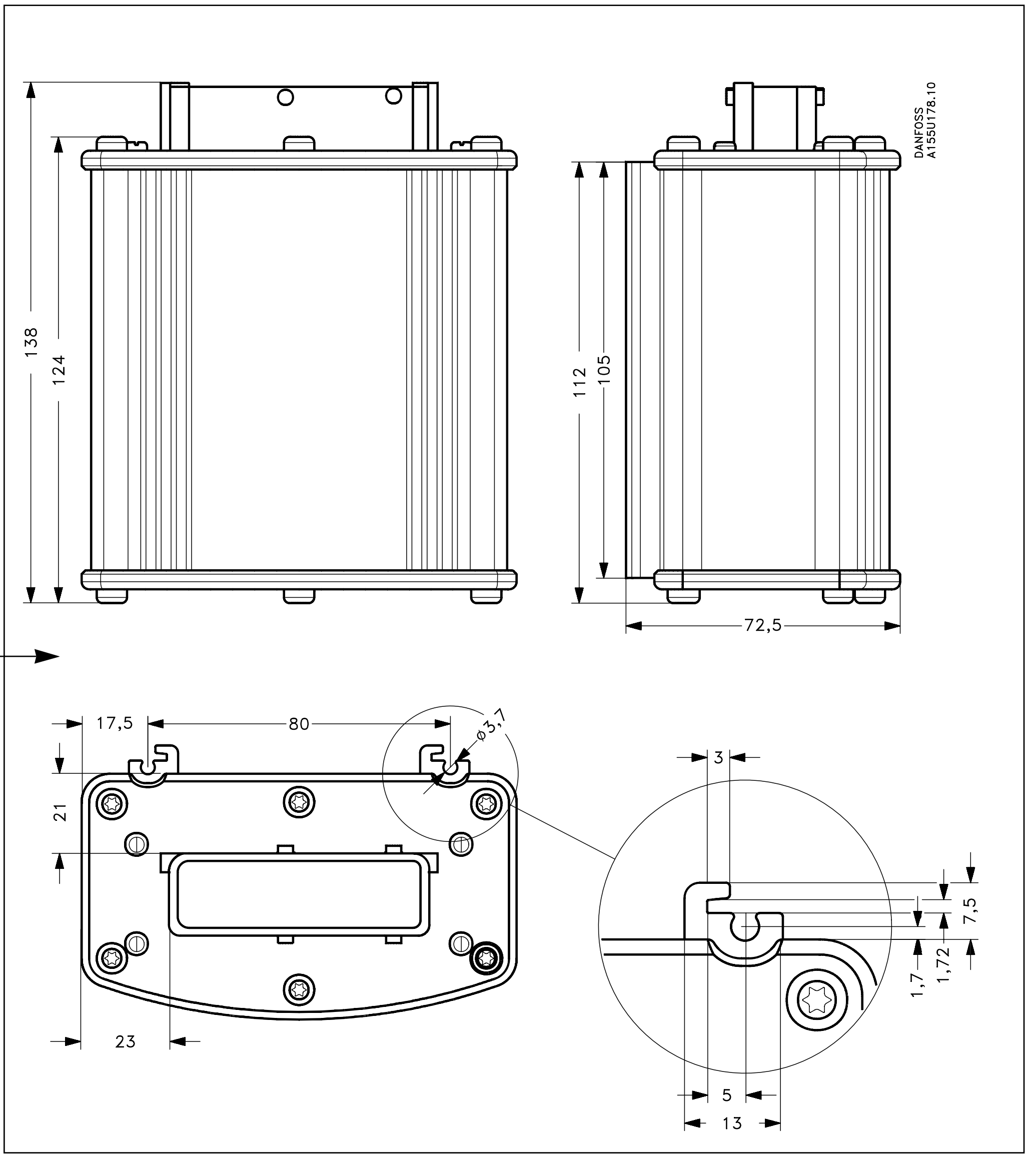
Index	Subindex	Parameter Name
1000		Device Type
1001		Error Register
1003		Pre-defined error field
1003	0	Number of Errors
1003	1	Last Error Occured
1004		Number of PDOs
1004	0	Number of PDOs supported
1004	1	Number of synchronous PDOs
1004	2	Number of asynchronous PDOs
1008		Device name
1009		Hardware Version
100A		Software Version
100B		Node-ID
100C		Guard Time
100D		Life time factor
100E		Node guarding ID
1011		Restore parameters
1011	0	Largest supported sub-index
1011	1	Restore all default parameters
1011	2	Restore communication default parameters
1011	4	Restore default function settings
1800		Number of parameters following
1800	0	Number of entries
1800	1	COB-ID used by PDO
1800	2	Transmission type
1A00		Transmit PDO mapping
1A00	0	Number of entries
1A00	1	Analog input 1
1A00	2	Analog input 2
1A00	3	Analog input 3
1A00	4	Analog input 4
1A00	5	Rest of Analog Inputs

Index	Subindex	Parameter Name
1A00	6	Digital input 1
3000		Baudrate
3002		Enable Guide function
3004		Enable Memory function
3005		Cyclic trigger
3006		Mapping structure
3006	0	Number of entries
3006	1	Prop 1
3006	2	Prop 2
3006	3	Prop 3
3006	4	Prop 4
3006	5	Push 3A
3006	6	Push 3B
3006	7	Push 4A
3006	8	Push 4B
3006	9	Push 5
3006	A	Push 6
3006	B	Push 7
3006	C	Push 8
3007		Memory function mapping
3007	0	Number of entries
3007	1	Proportional mapping
3007	2	Button used
6000		Digital input values
6000	0	Number of entries
6000	1	Read_8_Input_1H_8H
6401		Read_Analog_Input_16
6401	0	Number of entries
6401	1	Prop1
6401	2	Prop2
6401	3	Prop3
6401	4	Prop4

PVG CIP dimensions







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