Operating Manual
PSC-CAN / PSC-PROFI

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Table of Contents

1 General information

Please read this manual carefully before the start-up. Store it for later use in order to make sure that you can take it at any given time, even if there is no internet access available on the site.

Above all, please pay attention to the safety instructions and the warranty conditions.

1.1 Safety instructions and warranty

- From the date of purchase you receive a 2 year warranty on any defect during appropriate use. If applicable, please address to the distribution agency from which you bought the product.
- Only use the device for the functions which are described in the manual. Any inappropriate use will lead to the termination of the warranty claim.
- Pay attention the connections are fitted precisely and tightly. Wrong wiring might lead to damages on the product, on connected devices or on the environment of the product.
- Any modifications or other alteration of the product is prohibited.
- Handle the product with care. Even though it has been designed for industrial use and constructed in a robust way, crushes, whams or downfalls may lead to damages. The latter cases are not covered by the warranty.

Attention

There is no warranty claim for any damages on the device that are caused by means of inappropriate operation resulting from non-observance of the operation manual or disregard of the previously mentioned instructions.

No liability is assumed for any consequential damages.

1.2 Product support

At any time, this operation manual, a complementary technical datasheet, device related files as well as additional product support are available via internet under:

www.SupplyCom.de

If there is a need for further clarification, hints or questions, please always first address to the distribution agency from which you bought the product.

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2 Properties and applications

2.1 Properties

The Integrated SupplyCom is an interface for direct communication between analog programmable power supplies via interface to extern digital systems via a fieldbus interface.

The Integrated SupplyCom is now available in two interface versions:

CANopen	for the integration into a CANopen Bus System
PROFIBUS DP	for the integration into a PROFIBUS DP System

The configuration of the Integrated SupplyCom occurs via the serial interface and allows an easy parameterization on the correspondent power supply via the available standard profile. Simultaneously a customer matched user-profile can be set up.

The Integrated SupplyCom has following properties

- RS232 communication mode until 38400 baud via Standard SCPI instruction set IEEE-1174
- Communication by CANopen Standard until 1-Mbit
- Communication by PROFIBUS DP Standard until 12-Mbit
- Rectification of the selected voltage and current via an analog output of 14-bit resolution
- Monitoring of voltage and current via an analog input of 14-bit resolution
- Full support of the power supply's specific interface assignment via a 6 pole digital input (e.g. notice voltage and current limitation - CV/CC Status etc.), and a digital output (e.g. regulation of the remote ShutDown - RSD, etc.)
- Galvanic isolation between the power supply and the interface until min. 560V DC
- Menu controlled device configuration and assessment via an ASCII Terminal
- Upgrade of required specific adjustments for the regulation of the power supply via available power supply profiles
- Highly scanning rate of 1kSa/s
- Measuring accuracy for current and voltage: < 0,1%
- Programming accuracy for current and voltage: < 0,1%
- External data logging support via polling
- Monitoring of the parameter status of the power supply

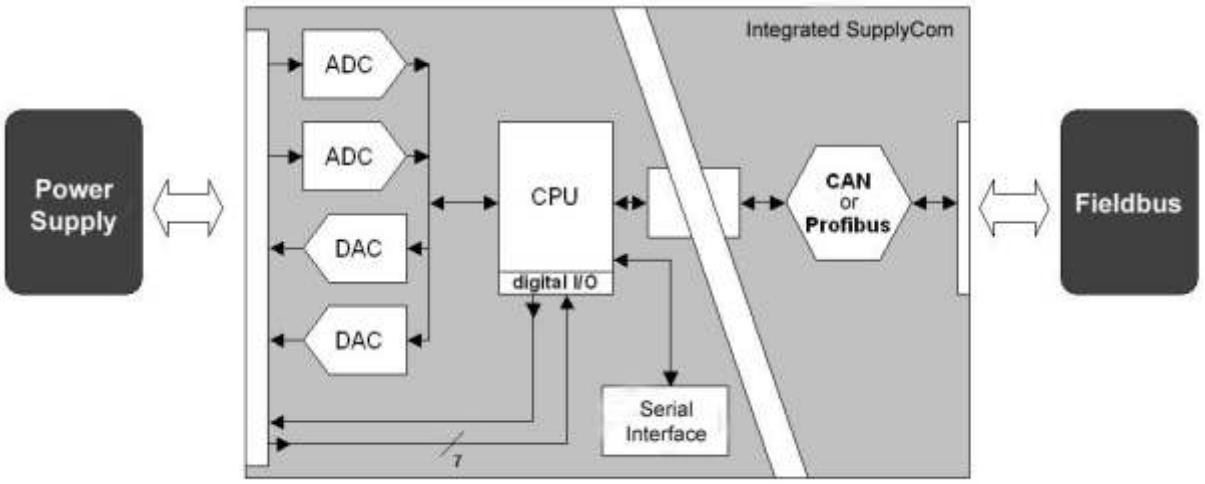


fig. 1 - Function diagram of the Integrated SupplyCom

2.2 Applications

Depending on the property of the power supply following applications are realizable:

- Direct regulation and control of the current and voltage process in automatic systems via the fieldbus interface
- A parallel setting between several power supplies via galvanic isolation
- Creation of uncontrolled waveforms
- Level control of the output in connection with operational alarm
- External visualization support by polling

Application examples:

- Check and test systems for development and production
- Process and production automation for assembly systems and test fields
- Computer-controlled tests and test arrangements
- Control of power supplies in time-critical systems

2.2.1 Supported devices

Delta Elektronika has developed devices, which are provided for internal interface cards.

3 Technical data

3.1 Pin assignments

3.1.1 Serial interface (SV3)

The connection to the serial interface occurs via a 10 pole header connector (fig. 2).
A RS232 adapter board with driver (SCI to RS232) is required to connect the serial interface (SCI) to a RS232 interface.

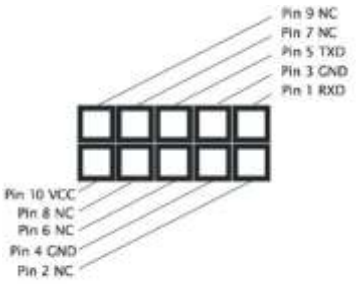


fig. 2

3.1.2 CAN-Bus (X1,X2)

The connection to the CAN-Bus occurs via a 9 pole Sub-D-connector (male and female)(fig. 3).

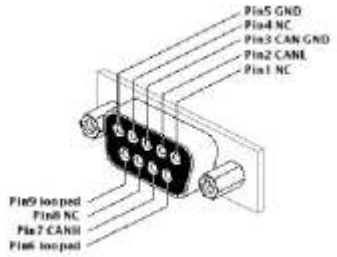


fig. 3

3.1.3 PROFIBUS DP (X1)

The connection to the PROFIBUS occurs via a female 9 pole Sub-D-connector (fig. 4).

Pin	Description
1	Screen/Functional earth - NC
2	GND 24 V optional - NC
3	B-line (+)
4	RTS
5	GND 5 V
6	+ 5 V
7	24 V optional - NC
8	A-Line (–)
9	Repeater control signal optional - NC

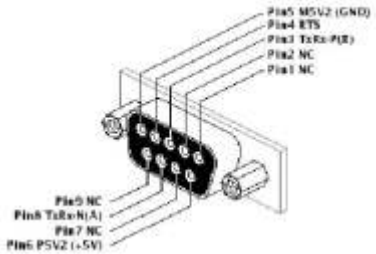


fig. 4

3.1.4 Power supply interface (SV1)

The power supply interface is accomplished with a 20 pole header connector (fig. 5). The specific device assignment of the digital pins to the in-/output of the Integrated SupplyCom is deposited in the configuration menu of the device profile and will be saved in the configuration.
The power supply of the Integrated SupplyCom occurs directly via the power supply interface.

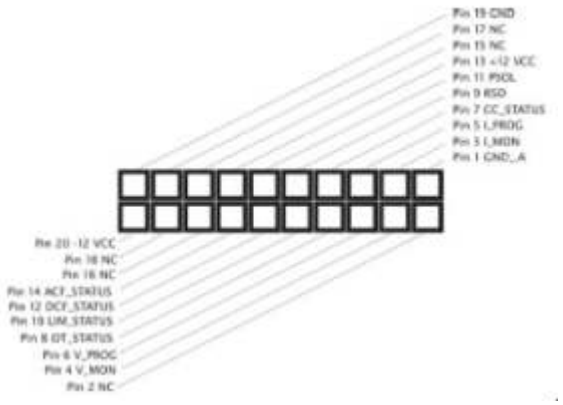


fig. 5

3.1.5 Address board P578 (SV4)

The card, on which the manual entry of the node address for CAN and Profibus occurs, is connected to the Integrated SupplyCom via a 16 pole header connector (fig. 6).

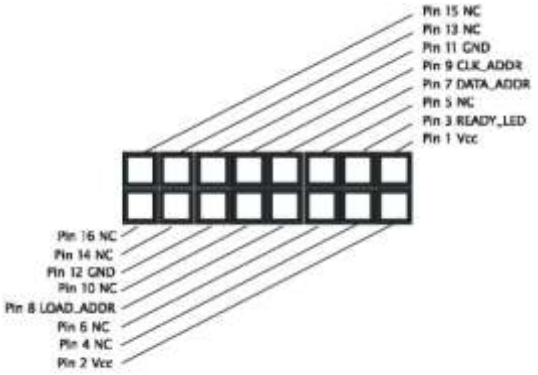


fig. 6

3.2 Electrical properties

$0°C \leq T_A \leq 70°C$ unless noted otherwise

Parameter	Conditions	Min	Typ	Max	Unit
Supply Voltage		11	12	12.5	V
Auxiliary Supply		− 11	12	12.5	V
Power Consumption				3	W
Analog Input Characteristics	T_A = +25°C unless otherwise noted				
Input Offset Voltage	(FSR = 0 - 5 V)		± 1.0	± 2.5	mV
Input Bias Current	(FSR = 0 - 5 V)		5	10	nA
Input Impedance	(FSR = 0 - 5 V)		1000		kΩ
Resolution			14		bits
Total Unadjusted Error (note 1)				± 0.1	% of FSR
Dynamic Input Characteristics					
Sample Rate per channel			1		kSa/s
Cut-off Frequency			500		Hz
Analog Output Characteristics					
Output Voltage High	(FSR = 0 - 5 V)		5.000		V
Offset Voltage	(FSR = 0 - 5 V)		0.06	0.3	mV
Resolution			14		bits
Output current				10	mA
Total Unadjusted Error (note 1)				± 0.1	% of FSR
Short Circuit Time		unlimited			
Dynamic Output Characteristics					
Refresh Rate			1		kSa/s
Settle Time			1		ms
Digital Input Characteristics					
Input Voltage High		2.7	5	5.25	V
Digital I/O Characteristics	R_{OUT} = 100R				
Input Voltage High		2.7	5	5.25	V
Output Voltage High		4.75	5	5.25	V
Output Short Circuit Current				± 50	mA
Short Circuit Time		unlimited			
Digital Interfaces	galvanic isolation between digital & analog interface				
Isolation Voltage		560			VDC

note 1: TA = 0 - 70°C
note 2: Human Body model ± 2kV

CE

3.3 Dimensions

CANopen Module (fig. 7).

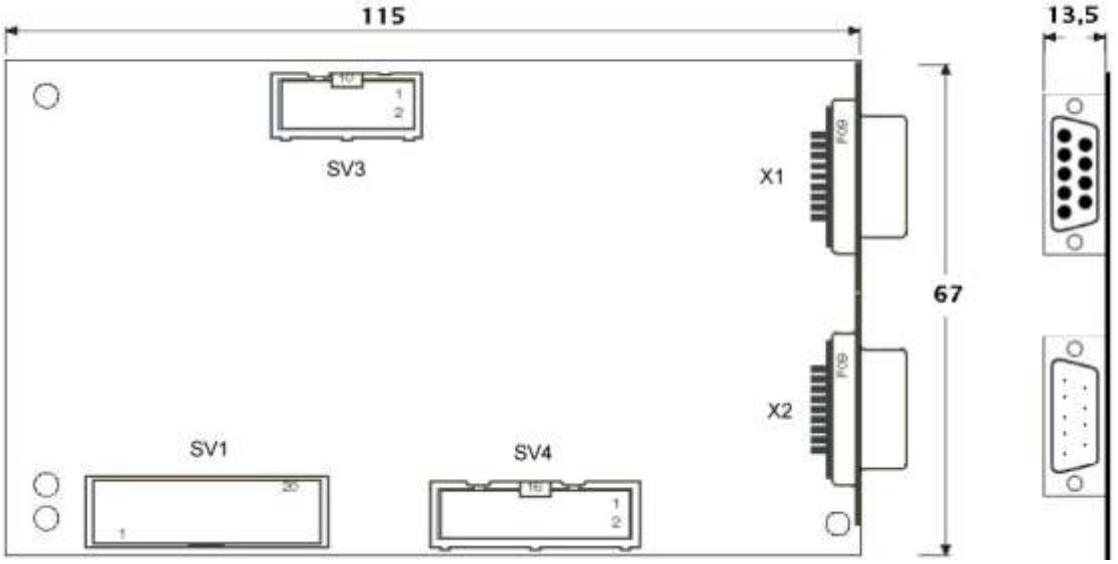


fig. 7

Profibus Module (fig. 8).

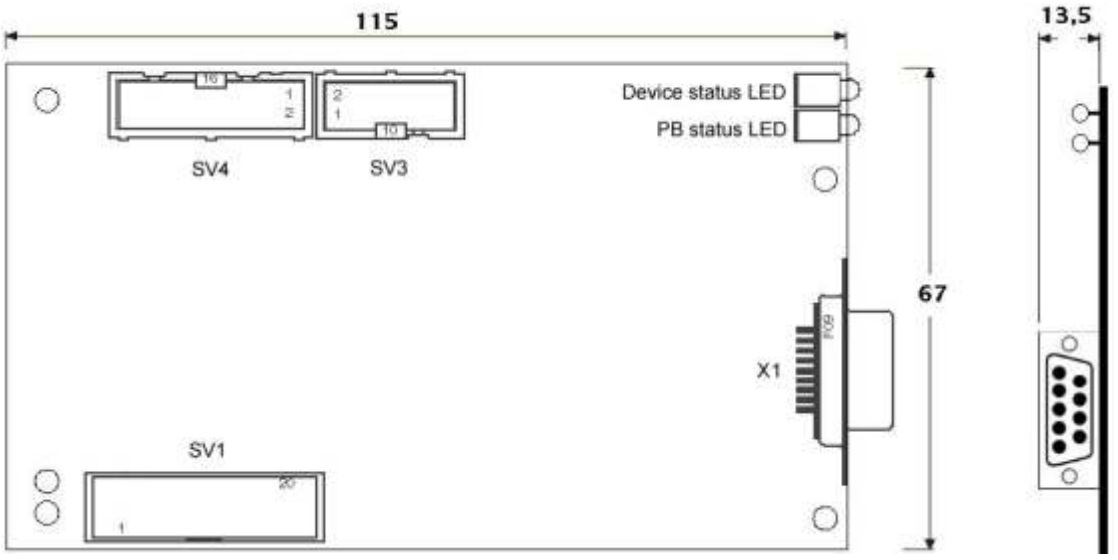


fig. 8

4 Communication and operation

The operation of the Integrated SupplyCom can occur in two communication modes and two different modes of operation.

4.1 Communication mode

The Integrated SupplyCom module has two communication modes:

MODE	DESCRIPTION
CANopen or PROFIBUS DP	Communication via a Fieldbus system. Only the operation mode "Application mode" is possible (see below).
Serial Interface	Point-to-point communication via the serial Interface. In this mode the serial communication mode as well as the configuration mode are available.

The change between the communication modes happens in the configuration mode.

4.2 Mode of operation

The Integrated SupplyCom module has two modes of operation:

MODE of OPERATION	DESCRIPTION
Configuration mode	In this mode the configuration of the module can be checked or changed. The preset configuration remains until any changes are made. The communication occurs via the serial interface.
Communication mode	This is a special mode of operation to use the serial Interface in application mode. However, an appropriate configuration is required.  The SupplyCom can only be calibrated in this mode of operation.
Application mode	This is the standard mode of operation. However, an initial configuration is required.

As soon as it has been activated, the Integrated SupplyCom will check its memory for a valid configuration. If there is none, the module can only be started in the configuration mode.

After a successful configuration, once activated the module starts automatically in the application mode (CAN or Profibus) or in the RS232 communication mode and after 5 seconds, it is ready for use.
If the active configuration of the device shall be checked or changed, then a change of the configuration mode is required. This will happen within the first seconds after activation by simultaneously pressing the keys CTRL+E.
After expiry of the time slot without pressing the command CTRL+E the module will start in the application mode.
To change the configuration mode, the device has to be rebooted.

4.3 Status of the display

The current operation mode can be determined via the LED in the following way:

Configuration mode	CANopen: internal LED alternately flashes in red and green PROFIBUS: the red device status LED flashes quickly
Application mode	see descriptions in the respective application descriptions
Communication mode	CANopen: see descriptions in the respective application the green LED on the Address board P578 is off PROFIBUS: see descriptions in the respective application the green LED on the Address board P578 is off

5 Configuration via ASCII terminal

5.1 Proceeding

The configuration of the Integrated SupplyCom modules occurs via a terminal program, that is connected with the module via the serial interface.

Therefore we recommend the terminal program Tera Term.

In the following a description of the required settings in the program Tera Term is supplied. If another program should be used, the adaption of the utility program has to be conducted in an analog way.

Procedure:

1. Select the communication interface: specification of the port on which the serial connection is built up (COM1, COM2, ...)
2. Terminal settings:
   a. New-Line:
      Receive: CR
      Transmit: CR-LF
   b. Local Ech activated
3. Settings of the serial port
   a. bits per second 9600
   b. data bits 8
   c. parity none
   d. stop bits 1
   e. flow control none

Now there should be a connection between the PC and the Integrated SupplyCom.

5.2 Pin assignment of the serial interface

See "Technical data" (page 3 - 1).

5.3 Configuration procedure

The Integrated SupplyCom module requires a valid configuration for the application operation.

Proceeding:

1. Connect the Integrated SupplyCom with the PC via the RS232 Adapter board (SCI to RS232)
2. Start and set the Tera Term Programs
3. Apply the supply voltage on the Integrated SupplyCom
4. During the initial configuration press shortcut CTRL-E and enter the command
5. If there is a configuration saved in the memory, it is possible to start the configuration mode within the first seconds via CTRL-E
6. Listing of supported profiles via command PL
7. Entry of the power supply unit profile via the profile number e.g. P=1 (see the list of instructions)
8. If no profile matches, a manual entry can be made via PU
9. Entry of the bus configuration via command B
10. By means of the command DP and DB the entered values can be checked
11. After a successful configuration, first unplug and then plug in the power supply of the Integrated SupplyCom
12. After 5 seconds the Integrated SupplyCom will start in the application mode

5.4 List of instructions for the configuration

COMMAND	DESCRIPTION
H or ?	List of instructions
L	Select the language
PL	Display list of the power supply unit profiles
P=	Select the profile number
DP	Display of the active profile
PU	Enter user-defined profile
B	Enter the bus configuration
DB	Display of the bus configuration
EXIT	Exit configuration mode

5.5 Information regarding the configuration commands

Only those characters are accepted that are important for an entry.
All entered letters are automatically converted into capitals.

5.5.1 Setting of the power supply configuration

command P=: The selected profile number is simply added behind the command
e.g. P=1, or P=25, ...
Via the selected profile, the previous calibration is deleted.

command PU: Via the selected profile, the previous calibration is deleted.
One by one the following configuration data are retrieved:

UMax [V]: Entry of voltage in Volt or Millivolt
If entered in Volt, the measuring unit "V" can be dropped, e.g. 300, 10
If entered in Millivolt, simply add an "M", e.g. 100M, 1500M
The maximum value which can be entered in Volt is 10000 V
The maximum value which can be entered in Millivolt is 65 V

IMax [A]: Entry of current in Ampere or Milliampere
If entered in Ampere, the measuring unit "A" can be dropped, e.g. 24, 5
If entered in Milliampere, simply add an "M", e.g. 20M, 150M
The maximum value which can be entered in Ampere is 10000 A
The maximum value which can be entered in Milliampere is 65 A

command DP: An overview of all set configuration parameters is displayed.
In that overview, the pin support is also specified in form of internal values of the equipment:

Use Mask: Indicates which digital pins are used.
0 = not connected / 1 = connected
Displayed as hexadecimal value. Value margin: 0_h - $7F_h$

Supported digital pins*						
7	6	5	4	3	2	1
←			Use Mask			→
UM bit	UM bit	UM bit	UM bit	UM bit	UM bit	UM bit

Calibration data: The actual calibration value of the current channel.

* Pin number is not identical with the connector assignment.

5.5.2 Setting of the bus configuration

Command B: One by one the individual configuration parameters are queried. Only those queries are displayed which are relevant for the equipment version and for the selected mode.

Communication mode: Entry of the desired communication on the communication interface in the application mode (e.g. 0 for RS232, 1 for the CANopen or for the PROFIBUS). Only those bus types are displayed which are supported by the hardware.

Baud rate: Entry of the baud rate during the operation.
RS232: e.g. 9600 for 9600 baud
CANopen: e.g. 125 for 125 kbaud.
The setting allows only that the baud rate, used in the operation, can be set.
Via H the baud rate allowed for the setting can be displayed.

	Note 1 In the configuration mode only a transfer rate of 9600 baud is used. That rate can not be changed.
	Note 2 In the PROFIBUS application mode the baud rate is automatically set. So, there is no query for the PROFIBUS configuration.
	Note 3 With the startup of the CAN application mode the baud rate can be added. See "Baud rate" at page 7 - 3

Parity bit Setting of the parity for RS232 communication mode. (e.g. N for no parity, O for odd, E for even.)

Node address The node address for CAN and PROFIBUS entered on the DIP switch of the Address board P578 shall be read automatically with the startup of the application mode.

	Note For the CANopen, the identifiers correspond to a priority in the bus communication. With a higher priority of the Integrated SupplyCom module should be chosen a low address or vice versa.

6 RS232 communication mode

6.1 Basic information

The pin assignment on the 10 pole header connector is described in chapter "Technical data" (see p. 3 - 1).
The applied instruction set is fully compatible with the SCPI-protocol according to the IEEE1174-standard.

So the device can be accessed via applications such as LabView/LabWindows^{â} or as well as directly via ASCII Terminal by means of the listed commands.

6.2 Required settings of the equipment

The operation requires a valid configuration of the device. The configuration can only occur in the configurator via the serial interface.
The handling of the configurators is described in chapter "Configuration via ASCII terminal" (see p. 5 - 1).
The relevant settings for the Bus configuration are made via command B.

If a query (? or H) is made, the answer will be supplied immediately via the serial interface.
If an incorrect report is sent, the LED display flashes red.
As soon as the next correct command is entered, the LED will become green.

6.3 Instruction set

The used SCPI instruction set is listed on following page.
The commands can be transferred directly from the application via the serial interface.

Attention:

	The analog values for current (A) and voltage (V) are imported or exported as floating point number separated by a decimal point, 3 digits after the decimal point (e.g. 20.123).
	The module acts as slave during the poling operation. In case of information retrieval of actual values, the latter ones are directly delivered. - Analog values in A or V as floating point number with 3 digits after the decimal point (e.g. 20.123). - Digital values as numerical value "0" (applies) or "1" (does not apply).

Meaning of the command codes for the RS232 communication mode:

<wsp> space
<nr> floating point number, separated by decimal point; 3 digits after decimal point (e.g.20.123), entry in Volt
<hexvalue> hexadecimal numeric value
{1|0} Only 1 or 0 permitted

<table>
<tr><th>COMMAND</th><th>DESCRIPTION</th></tr>
<tr><td>so:vo<wsp><nr></td><td>Setting of the output voltage of the power supply</td></tr>
<tr><td>so:cu<wsp><nr></td><td>Setting of the output current of the power supply</td></tr>
<tr><td>so:vo?</td><td>Query of the set output voltage of the power supply</td></tr>
<tr><td>so:cu?</td><td>Query of the set output current of the power supply</td></tr>
<tr><td>so:fu?</td><td>Queries of the digital ports (result in hexadecimal numeric value) bit value:
<table>
<tr><td>0x01</td><td>0x02</td><td>0x04</td><td>0x08</td><td>0x10</td><td>0x20</td><td>0x40</td></tr>
<tr><td>CCS (PIN7)</td><td>LIM (PIN10)</td><td>DCF (PIN12)</td><td>ACF (PIN14)</td><td>RSD (PIN9)</td><td>PSOL (PIN11)</td><td>OT (PIN8)</td></tr>
</table></td></tr>
<tr><td>so:vo:ma<wsp><nr></td><td>Setting of the maximum output voltage of the power supply
Attention: the Integrated SupplyCom loses this information after a power failure. Thereafter the setting according to the configurator is effective.</td></tr>
<tr><td>so:cu:ma<wsp><nr></td><td>Setting of the maximum output current of the power supply
Attention: the Integrated SupplyCom loses this information after a power failure. Thereafter the setting according to the configurator is effective.</td></tr>
<tr><td>so:vo:ma?</td><td>Queries of the maximum output voltage of the power supply</td></tr>
<tr><td>so:cu:ma?</td><td>Queries of the maximum output current of the power supply</td></tr>
<tr><td>so:fu:rsd<wsp>{1|0}</td><td>Transfer of the power supply to Remote ShutDown (1) or switch on of the power supply (0)</td></tr>
<tr><td>so:fu:rsd?</td><td>Queries of the current RSD status</td></tr>
<tr><td>sapphics?</td><td>Queries whether the power supply operates in current limitation mode - "0" (applies) or "1" (does not apply)</td></tr>
<tr><td>me:vo?</td><td>Measurement of the current output voltage</td></tr>
<tr><td>me:cu?</td><td>Measurement of the current output current</td></tr>
<tr><td>da:vo?</td><td>Starts a dialog to the determination of gain and offset errors like subsequent calibration of the DA and AD converters (U_{IN} / U_{OUT})</td></tr>
<tr><td>da:cu?</td><td>Starts a dialog to the determination of gain and offset errors like subsequent calibration of the DA and AD converters (I_{IN} / I_{OUT})</td></tr>
<tr><td>co:us?</td><td>Queries of the Use Mask (used digital pins)</td></tr>
<tr><td>co:us<wsp><hexvalue></td><td>Setting of the Use Mask</td></tr>
</table>

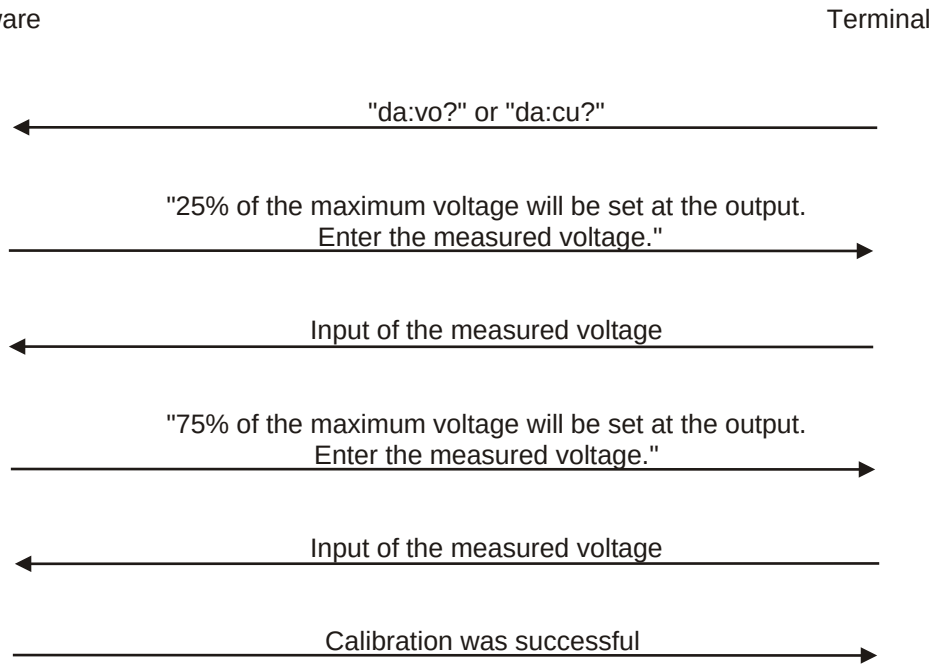
Example commands:

Setting of a voltage of 25,7 V	: so:cu 25.7
Correction of the maximum voltage of the power supply on 15,25 V	: so:vo:ma 15.25
Start of the calibration of the voltage channels	: da:vo?

6.4 Calibration of the DA/AD Channels

The calibration occurs in the RS232 communication mode.
The accuracy of the AD/DA converters is based on many factors. Significant are the offset and gain errors. The offset error includes the deviation of the minimum expected voltage, the gain error includes the deviation in the ascent of the transition function. The calibration will minimize as well the gain error as the offset error.
At the same time, the program and the control channel of the voltage or current are calibrated during the calibration. The calibration will start with the commands da:vo? and da:cu?.
During the calibration process the voltage or current will change. These must be measured with a precise meter and be entered in the terminal program
Because only the voltage in the power supply is issued when the current is higher than 0, only 10% of the maximum current is created during the calibration of the voltage and vice versa.
The analog values are read as floating point number (separated by decimal point; with maximum 3 digits after decimal point e.g. 20.123).

6.5 Calibration dialog of the DA converter



7 CANopen application mode

7.1 Basic information

7.1.1 CANopen user organization

Further information regarding CAN and CANopen basics and protocols see CiA user organization (CAN in Automation).

CAN in Automation
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Fax no: +49-9131-69086-79
E-Mail: headquarters@can-cia.org
Internet: www.can-cia.org

7.1.2 CANopen functionality

The CANopen functionality is equivalent to a Master / Slave behaviour subject to CiA Draft Standard 401.

Following CANopen features are supported:

- SYNC Object
- Emergency Object
- Node Guarding
- Heartbeat
- Expedited and non-expedited SDO Transfer
- CANopen Indicator LED

There is no support for:

- SYNC Master
- Emergency Inhibit
- Time Stamp
- SDO Block Transfer
- SDO Manager
- STORE / RESTORE
- NMT Master
- LSS

7.1.3 Operation in a specific CAN network

The operation of the PSC-CAN module is also possible in a specific CAN network. However, this requires detailed know-how and integration of the applied specific identifiers.
For this purpose, please address to the manufacturer.

Basically, the following applies:

- Identifiers that arise for the module from the default identifiers listed below, may not be used.
- By default, only 11-bit identifiers are supported.
  Attention: if the CAN-network requires the use of 29-bit extended format, then such a software adaption can be made on request.
- It is mandatory to send the message "Start Remote Node" to the node.

7.1.4 Default identifier

The COB-ID (CAN Identifier) consist of 4-bit for the function and for 7-bit for the node number. The areas for the individual functions can be found in the table below in which xxxxxxx represents the binary node address of the CANopen device.

Identifier (binary) MSB	LSB	Identifier (decimal)	Identifier (hexadecimal)	Meaning / Function
0000	0000000	0	0	Network management
0001	0000000	128	80	Synchronisation
0001	xxxxxxx	129 - 255	81 - ff	Emergency
0011	xxxxxxx	385 - 511	181 - 1ff	Transmit PDO 1
0100	xxxxxxx	513 - 639	201 - 27f	Receive PDO 1
0101	xxxxxxx	641 - 767	281 - 2ff	Transmit PDO 2
0110	xxxxxxx	769 - 895	301 - 37f	Receive PDO 2
0111	xxxxxxx	897 - 1023	381 - 3ff	Transmit PDO 3
1000	xxxxxxx	1025 - 1151	401 - 47f	Receive PDO 3
1001	xxxxxxx	1153 - 1279	481 - 4ff	Transmit PDO 4
1010	xxxxxxx	1281 - 1407	501 - 57f	Receive PDO 4
1011	xxxxxxx	1409 - 1535	581 - 5ff	Send SDO
1100	xxxxxxx	1537 - 1663	601 - 67f	Receive SDO
1110	xxxxxxx	1793 - 1919	701 - 77f	NMT error control

7.1.5 Operating states

STATE	DESCRIPTION
Pre-operational	Only SDO can be used
Operational	Only SDO and PDO can be used
Stopped	Only NMT communication possible

7.2 Required instrument settings

The operation requires a valid configuration of the device. The configuration can only occur in the communication mode "RS".
The handling of the configurators is described in chapter "Configuration via ASCII terminal" (see p. 5 - 1).
The relevant settings for the Bus configuration are made via command B.

7.2.1 Baud rate

The baud rate is set by means of the configurator via the serial interface. Only the indication of a speed value according to the table below is admissible. If the speed can be chosen freely and no special requirements exist, a baud rate of 125 kbit/s is recommended. To find out how to set the baud rate, please check the documentation on the configurator.
In further operation the baud rate is additional adjustable via the DIP switch A1 to A8 of the Address board. For this purpose, set switch A8 to 1 to select the baud rate. After that the device must be started in the CANopen application mode.
Because the DIP switches are also used for the setting of the node address, the last setting of the node address will now be used.

Baud rate	max. bus length	DIP value
1 Mbit/s	25 m	128
800 kbit/s	50 m	129
500 kbit/s	100 m	130
250 kbit/s	250 m	131
125 kbit/s	500 m	132
100 kbit/s	700 m	133
50 kbit/s	1000 m	134
20 kbit/s	2500 m	135
10 kbit/s	5000 m	136

7.2.2 Node address

The specification of the node address is made via the Address board P578.
The address will be set on the DIP switches as a 7-bit binary number. The switch A1 is the LSB and the switch A7 is the MSB (fig. 9).

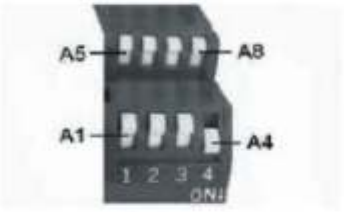

fig. 9

The valid node address range is 1...127.

Examples:
Address 1 is equivalent to the binary number 0000001 (A1 = ON, A2-A7 = OFF).
Address 63 is equivalent to the binary number 0111111 (A1-A6 = ON, A7 = OFF).

Attention:

	A change of the address or the baud rate is only possible with a restart of the device.
	The node address is read when the switch A8 = OFF, otherwise the baud rate is read.

7.2.3 Change of the communication mode

After having set the configuration, the module is separated from the RS interface and switched off (disconnection of the power supply).

7.3 Connection and operation

7.3.1 Connection of the module to the CAN network

Before making a connection to a CAN network be sure the module is configured accordingly. The CAN connection is made via the 9 pole Sub-D female connector.
The 9 pole Sub-D-connector is intended for attaching a 120 Ω terminator or for continuing the bus (if this hasn't been realized via the connector). Both connections are switched in parallel.

7.3.2 Indicator LED

The operation state is displayed via a two-colored LED (green/red).

After switching ON, for 5 seconds the LED will alternately flash quickly in red and green. During this time the configuration can be started in the RS232 communication mode. It is described in chapter "Configuration via ASCII terminal" (see page 5 - 1).

At the end of the configuration period, the LED continues to flash green. This indicates that the PSC-CAN is in the "pre-operational" state. After receipt of the message Start Remote Node the LED is continuously illuminated in green. A red illumination or blinking indicates an error. More details regarding the behaviour of the LED can be obtained from the standard norm CiA DR-303-3.

7.4 Process data objects (PDO)

Process data provide a fast data transfer. Therefore the transmission is effected connectionless. The transmission is secured via the lower protocol layers (data link layer) of the CAN.

7.4.1 PDO mapping

In the PDO only such data can be transferred that are saved in the object directory.
PDO mapping indicates which data from the object directory can be put into which PDO and in what order. For the PSC-CAN the norm DS-401 of the CiA was used. This latter norm requires that the digital outputs are mapped in "Receive PDO 1". The analog default values (current, voltage) are mapped in "Receive PDO 2". In "Transmit PDO 1" the digital inputs are mapped. "Transmit PDO 2" contains the analog input values (current, voltage).

The following structure and qualification is applied for the tables below.

Byte qualification	1 Byte	1 Byte	1 Byte	1 Byte
Quality rating (decimal) within the byte	Bit number or decimal quality rating within the byte			
Identifier / name / significance	Identification, transmission of the analog values occurs with the prefix "m" (in mA or mV)			
	RFU: reserved for future use i.e. a part of PDO, but contents can not be used			
	Available (empty), i.e. not a part of PDO and so no physical transmission			

Attention:

The analog values can easily be imported in 32-bit integer variables (VINT32) or unsigned integer (VUINT32). The TPDO1 / RPDO1 data can be transferred to char variables.

The data transmission is carried out in "Little Endian Format" (lowest byte first). On request, this behaviour can be changed (swapping).

Several exemplary telegrams are listed in the chapter "Examples for CANopen messages" (see page 7 - 8).

RPDO1 (2 Byte)*

1 Byte								1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte
128	64	32	16	8	4	2	1							
RFU	RFU	MS_PAR	OVPLS	VMS	GNDMS	RSD	DIS	7 byte unused						

RPDO2 (8 Byte)

1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte
entire 32 bit				entire 32 bit			
I program				V program			

TPDO1 (2 Byte)*

1 Byte								1 Byte								
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	
RFU	RFU	RFU	RFU	MS_PAR	OVPLS	VMS	GNDMS	ACF	DCF	LIM	OT	PSOL	CCS	RSD	DIS	6 Byte unused

TPD02 (8 Byte)

1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte
entire 32 bit				entire 32 bit			
I monitor				V monitor			

* The designations of the digital pins are listed at the end of this manual.

7.5 Service data objects (SDO)

The default SDO is supported. This is a server SDO, i.e. the module can be accessed by other modules but the module itself has no access to objects of other modules. Via the SDO entries can be read and written in the object directory.

7.6 Object directory

INDEX	OBJECT
0000_h	Unused
0001_h - $025F_h$	Data types
0260_h - $0FFF_h$	Reserved
1000_h - $1FFF_h$	Communication profile
2000_h - $5FFF_h$	Manufacturer-specific part
6000_h - $9FFF_h$	Standardized device profile
$A000_h$ - $BFFF_h$	Standardized interface profile
$C000_h$ - $FFFF_h$	Reserved

7.6.1 Entries in the communication profile

Index	Subindex	Name	Attribute	Data Type	Default Value
0x1000	0	Device type	CONST	UNSIGNED32	0x000F0191
0x1001	0	Error register	RO	UNSIGNED8	0
0x1003	0	Number of errors (standard error field)	RO	UNSIGNED8	0
0x1003	1	Standard error field	RO	UNSIGNED32	0
0x1003	2	Standard error field	RO	UNSIGNED32	0
0x1003	3	Standard error field	RO	UNSIGNED32	0
0x1003	4	Standard error field	RO	UNSIGNED32	0
0x1003	5	Standard error field	RO	UNSIGNED32	0
0x1003	6	Standard error field	RO	UNSIGNED32	0
0x1003	7	Standard error field	RO	UNSIGNED32	0
0x1003	8	Standard error field	RO	UNSIGNED32	0
0x1003	9	Standard error field	RO	UNSIGNED32	0
0x1003	10	Standard error field	RO	UNSIGNED32	0
0x1003	11	Standard error field	RO	UNSIGNED32	0
0x1003	12	Standard error field	RO	UNSIGNED32	0
0x1003	13	Standard error field	RO	UNSIGNED32	0
0x1003	14	Standard error field	RO	UNSIGNED32	0
0x1003	15	Standard error field	RO	UNSIGNED32	0
0x1003	16	Standard error field	RO	UNSIGNED32	0
0x1005	0	Sync. ID	RW	UNSIGNED32	0x00000080
0x1008	0	Device name	CONST	STRING	PSC-CAN
0x1009	0	Hardware version	CONST	STRING	Hardware version
0x100A	0	Software version	CONST	STRING	Software version
0x100C	0	Guard time	CONST		
0x100D	0	Life time	CONST		0
0x1014	0	Emergency ID	RW	UNSIGNED32	$NODEID + 0x00000080
0x1017	0	Heartbeat	RW	UNSIGNED16	0
0x1018	0	Number of entries (Identity Object)	RO	UNSIGNED8	4
0x1018	1	Vendor_ID	RO	UNSIGNED32	0x00000000
0x1018	2	Product Code	RO	UNSIGNED32	Our product code
0x1018	3	Revision Number	RO	UNSIGNED32	Our revision number
0x1018	4	Serial Number	RO	UNSIGNED32	Our serial number
0x1400	0	Number of entries (1 receive PDO communication parameter	RO	UNSIGNED8	2
0x1400	1	COB-ID	RW	UNSIGNED32	$NODEID + 0x200
0x1400	2	Transmission type	RW	UNSIGNED8	255d
0x1401	0	Number of entries (2 receive PDO communication parameter)	RO	UNSIGNED8	2

Index	Subindex	Name	Attribute	Data Type	Default Value
0x1401	1	COB-ID	RW	UNSIGNED32	$NODEID + 0x300
0x1401	2	Transmission type	RW	UNSIGNED8	255d
0x1600	0	Number of entries (RPDO1 mapping parameter)	RO	UNSIGNED8	2
0x1600	1	PDO mapping entry	RO	SIGNED32	0x62000108
0x1600	2	PDO mapping entry	RO	SIGNED32	0x62000208
0x1601	0	Number of entries (RPDO2 mapping parameter)	RO	UNSIGNED8	2
0x1601	1	PDO mapping entry	RO	SIGNED32	0x64110120
0x1601	2	PDO mapping entry	RO	SIGNED32	0x64110220
0x1800	0	Number of entries (1 transmit PDO communication parameter)	RO	UNSIGNED8	2
0x1800	1	COB-ID	RW	UNSIGNED32	$NODEID + 0x40000180
0x1800	2	Transmission type	RW	UNSIGNED8	255d
0x1801	0	Number of entries (2 transmit PDO communication parameter)	RO	UNSIGNED8	2
0x1801	1	COB-ID	RW	UNSIGNED32	$NODEID + 0x40000280
0x1801	2	Transmission type	RO	UNSIGNED8	255d
0x1A00	0	Number of entries (TPDO1 mapping parameter)	RO	UNSIGNED8	2
0x1A00	1	PDO mapping entry	RO	UNSIGNED32	0x60000108
0x1A00	2	PDO mapping entry	RO	UNSIGNED32	0x60000208
0x1A01	0	Number of entries (TPDO2 mapping parameter)	RO	UNSIGNED8	2
0x1A01	1	PDO mapping entry	RO	UNSIGNED32	0x64010120
0x1A01	2	PDO mapping entry	RO	UNSIGNED32	0x64010220

7.6.2 Entries in the manufacturer-specific part

Index	Subindex	Name	Attribute	Data Type	Default Value
	No entries available				

7.6.3 Entries in the standardized device profile

Index	Subindex	Name	Attribute	Data Type	Default Value
0x6000	0	Number of entries	RO	UNSIGNED8	2
0x6000	1	Digital input 1	RO	UNSIGNED8	
0x6000	2	Digital input 2	RO	UNSIGNED8	
0x6200	0	Number of entries	RO	UNSIGNED8	2
0x6200	1	Digital output 1	RW	UNSIGNED8	
0x6200	2	Digital output 2	RW	UNSIGNED8	
0x6401	0	Number of entries	RO	UNSIGNED8	2
0x6401	1	Analog input 1	RO	UNSIGNED32	
0x6401	2	Analog input 2	RO	UNSIGNED32	
0x6411	0	Number of entries	RO	UNSIGNED8	2
0x6411	1	Analog output 1	RW	UNSIGNED32	
0x6411	2	Analog output 2	RW	UNSIGNED32	

Attention:
There is an .eds file (electronic datasheet), for the PSC-CAN module which describes the entire object directory. The .eds file has been checked syntactically by means of the program CANchkEDS 1.5.0.
For downloading the file please see chapter "Product support" (page 1 - 1).

7.7 Examples for CANopen messages

The exemplary messages shown below are based on a SupplyCom module with the node address 10_d (=A_h).

Message (hexadecimal)			Description
Boot up			After switching on the power supply unit, the PSC-CAN module sends the boot up message.
ID	DLC	Data	
70A	1	00	
Start Remote Node			The receipt of this message starts the node (the node leaves the pre-operational state and switches to operational state).
ID	DLC	Data	
000	2	01 0A	
Stop Remote Node			Stops the node.
ID	DLC	Data	
000	2	02 0A	
Enter Pre-operational State			The node switches to the pro-operational state.
ID	DLC	Data	
000	2	80 0A	
Reset Node			Reboot the node.
ID	DLC	Data	
000	2	81 0A	
Reset Communication			Restart of the communication.
ID	DLC	Data	
000	2	82 0A	

Message (hexadecimal)			Description
SYNC Message			Order to send TPD01 and TPD02 to the PSC-CAN module.
ID	DLC	Data	
80	0		
Transmit PDO 1			This message contains the digital outputs of the power supply unit encoded in the two data bytes.
ID	DLC	Data	
18A	2	00 00	
Transmit PDO 2			In the data field, there are 4 byte for the effectively delivered current and 4 byte for the measured voltage. The transmission occurs in mV and mA. (Example next line.)
ID	DLC	Data	
28A	8	00 00 00 00 00 00 00 00	
Transmit PDO 2 for reading out A/V			e.g.: read the actual values of 26.73A and 33.64V: 26.73A → 26730mA → 26730_d → $686A_h$ 33.64V → 33640mV → 33640_d → 8368_h NOTE: low byte first (Little Endian).
ID	DLC	Data	
28A	8	6A 68 00 00 68 83 00 00	
Receive PDO 1			Via RPDO1 the digital inputs of the power supply unit can be described.
ID	DLC	Data	
20A	1	02	
Receive PDO 2			RPD02 contains the analog setting values. The power supply unit uses the indication of the current value as current limitation. (Example next line.)
ID	DLC	Data	
30A	8	00 00 00 00 00 00 00 00	
Receive PDO 2 for setting A/V			e.g.: set the reference values of 5.6A and 152.4V: 5.6A → 5600mA → 5600_d → $15E0_h$ 152.4V → 152400mV → 152400_d → 25350_h NOTE: low byte first (Little Endian).
ID	DLC	Data	
30A	8	E0 15 00 00 50 53 02 00	
Remote-frame TPD01			This remote-frame serves for requesting the TPDO1. If the SYNC is active, the TPDO1 that has been sent last will be sent again.
ID	DLC	Data	
18A	R0		
Remote-frame TPD02			This remote-frame serves for requesting the TPDO2. If the SYNC is active, the TPDO2 that has been sent last will be sent again.
ID	DLC	Data	
28A	R0		
SDO			Example for an "Upload SDO Segment Protocol" message. In the example the object directory entry 1008h (name of the device) is read. CCS = 3 Toggle bit = 0
ID	DLC	Data	
60A	8	60 08 10 00 00 00 00 00	

8 PROFIBUS application mode

8.1 Basic information

8.1.1 Registered PROFIBUS user organization

For more details regarding PROFIBUS basics and protocols please contact the registered association "PROFIBUS Nutzerorganisation" (PNO).

PROFIBUS Nutzerorganisation e.V.
Haid-und-Neu-Strasse 7
D-76131 Karlsruhe
Phone no.: +49 721 9658-590
Fax no.: +49 721 9658-589
E-Mail: germany@profibus.com
Internet: www.profibus.com

8.1.2 PROFIBUS-DP functions

The PSC-PROFI module can be integrated into a PROFIBUS-DP network as a slave. In this process the DP-V0-standard is supported according to IEC 61784 Ed.1:2002 CPF 3/1 and the PROFIBUS protocol is supported according to IEC 61158.
The required setting of the slave address is made during the configuration of the module.
The GSD file which is required for the project planning as well as bitmaps for the display in the projection tool are provided as described below.

8.2 Required settings of the equipment

The precondition for an operation is a configuration of the device. The configuration can only be made in the configuration mode via the serial interface.
The handling of the configurators is described in chapter "Configuration via ASCII terminal" (page 5 - 1). The relevant settings for the bus configuration are made under command B.

8.2.1 Slave address

Before the start-up, the appropriate PROFIBUS slave address has to be communicated to the module. The specification of the Slave address is made via the Address board P578.
The address will be set on the DIP switches as a 7-bit binary number with the switches A1 till A7. The switch A1 is the LSB and the switch A7 is the MSB (fig. 10).

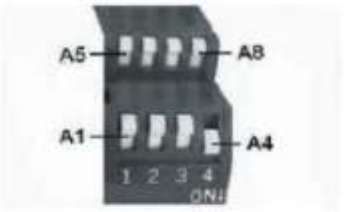

fig. 10

The valid slave address range is 1...127.

Examples:
Address 1 is equivalent to the binary number 0000001 (A1 = ON, A2-A7 = OFF).
Address 63 is equivalent to the binary number 0111111 (A1-A6 = ON, A7 = OFF).

8.2.2 Baud rate

No settings are required for the baud rate.
The baud rate is already predetermined by the PROFIBUS-DP Master. The device recognizes the appropriate baud rate automatically and phases accordingly. The following baud rates are supported.

Baud rate	Max. bus length
12 Mbit/s	100 m
6 Mbit/s	100 m
3 Mbit/s	100 m
1500 kbit/s	200 m
500 kbit/s	400 m
187.5 kbit/s	1000 m
93.75 kbit/s	1200 m
45.45 kbit/s	1200 m
19.2 kbit/s	1200 m
9.6 kbit/s	1200 m

In case of branch lines of up to 1500 kbit/s the line length should not exceed 6.6 m. The transfer rate for branch lines may not exceed 1500 kbit/s.

8.2.3 Exit of the configuration mode

After having completed the configuration, the PSC-PROFI is separated from the RS232 communication interface and switched off (disconnection of the power supply).
About 5 seconds after the restart, the application mode starts automatically.

8.3 Connection and operation

8.3.1 Network configuration

To ensure the module can work in a PROFIBUS-DP network, first the PSC-PROFI module has to be added to the PROFIBUS-DP network.
This is realized via the project planning of the PROFIBUS master.
The required files for the project planning (GSD-files, bitmaps) can be found via the internet under:

www.SupplyCom.de

The files are ready to be downloaded. These files must be copied into the respective directories of your configuration tool (e.g. the GSD-files into the folder "\GSD" in the subdirectory of the configuration tool).

8.3.2 Connection of the module to the PROFIBUS network.

Before making a connecting to a PROFIBUS network be sure the module is configured accordingly.
The PROFIBUS connection occurs via the 9 pin female Sub-D-connector.
Only use appropriate screened cables for PROFIBUS.
At the beginning and at the end, the bus has to be terminated by means of a terminating resistor.
If the module is an end device, then a respective connector with a terminator has to be used and the latter has to be activated.

8.3.3 Operating state (LED displays)

The state of the instrument and the modes of operation are indicated via the red device status LED. When the instrument is initialized, various states will pass through.
The state of the communication is indicated via the red PB status LED.
Once a valid PROFIBUS data communication is established, this LED goes out.
The status of the manual addressing is indicated via the green LED on the Address board P578

LEDs			Meaning	Cause
Device status LED (red)	PDO status LED (red)	P578 LED (green)		
OFF	OFF	OFF	No power supply	+ no power supply
Short flashing (1Hz)	no matter	Flashes	Manual addressing has failed	Failed to transfer the Address on P578, invalid address
Short flashing (1Hz)	no matter	OFF	RS232 communication mode	+ device in mode of operation
Short flashing (1Hz)	no matter	ON	Manual addressing has succeeded	The set up of the Address is valid, the address was taken over
Short flashing (1Hz)	OFF	ON	Application mode PROFIBUS	+ device in mode of operation
Short flashing (1Hz)	ON	ON	Error in the application mode PROFIBUS	+ incorrect connection to the bus (Check cable, connector, terminator)
				+ no Master available or Master is faulty

8.3.4 Start-up

After the configuration is completed, the module can be connected to the PROFIBUS-DP Network. Immediately the module participates in the data communication and begins with the standard initialization. Also, the configuration data are exchanged between the master and the slave and they are compared to the entries in the GSD file.

8.4 PROFIBUS communication

8.4.1 Data exchange between the master and the slave

The communication between the master and the slave is illustrated in a simplified way in the multi sequence chart below (fig. 11). The slave continuously delivers data from the power supply unit to the master. For more detailed information about the format of this output data telegram please see the chapter "Telegram structure" (page 8 - 4).
In each millisecond not only the voltage and current values of the power supply unit are measured but also the conditions of the digital ports.
These data are made available to the PROFIBUS Master as input data.
If the power supply unit is supposed to have another voltage or current value, the new values are sent to the slave as output data. The respective format of this input data telegram is identical with the output data telegram. For more detailed information pleas see the chapter "Telegram structure" (page 8 - 4).

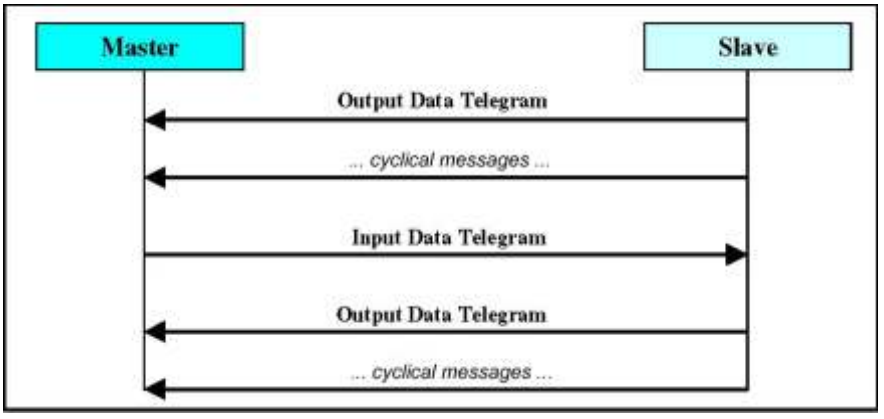

fig. 11

8.4.2 Telegram structure of the PROFIBUS messages.

Right after the connection of the PSC-PROFI module, data telegrams can be received by the master.
The structure of a data telegram is illustrated in the table below. This structure is identical for the cyclical messages from te module to the master (output data telegram) as well as for the setting commands from the master to the module (input data telegram).
The description of the digital pins is listed at the end of this manual (see page 9 - 2).

Input/output data telegram (length 10 byte)

1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte
2 x 8 bit		full 32 bit				full 32 bit			
Pin Status (see below)		Current (I program or I monitor)				Voltage (V program or V monitor)			

Pin status (2 byte)

First Byte								Second Byte							
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
ACF	DCF	LIM	OT	PSOL	CCS	RSD	DIS	RFU	RFU	RFU	RFU	MS_PAR	OVPLS	VMS	GNDMS

Notes:

The analog values can be easily imported in 32-bit integer variables (VINT32) or unsigned integer (VUINT32). The data for current and voltage can be stored in two char variables.

The data transmission is carried out in "Big Endian Format" (high byte first). On request, this behaviour can be changed (swapping).

8.4.3 Examples for PROFIBUS data telegrams

Message (hexadecimal)			Description
Output data telegram to read A/V			Read the actual values of 26.73 A and 33.64 V: 26.73A → 26730mA → 26730_d → $686A_h$ 33.64V → 33640mV → 33640_d → 8368_h NOTE: high byte first (Big Endian).
	current	voltage	
… ...	00 00 68 6A	00 00 83 68	
Input data telegram to set A/V			Set the reference values of 5.6 A and 152.4 V: 5.6A → 5600mA → 5600_d → $15E0_h$ 152.4V → 152400mV → 152400_d → 25350_h NOTE: high byte first (Big Endian)
	current	voltage	
… ...	00 00 68 6A	00 00 83 68	

9 Appendix

9.1 Firmware update

You have the possibility to keep the firmware of the module up-to-date via the site.

The required files, including the boot loader (flash tool) for automatic download of the firmware on the module, are available on the internet. The address is specified in the chapter "Product support" (see page 1 - 1). There you might also find which firmware version is compatible with your module.

Procedure:

1. Please mind the information below which is marked with "Attention".
2. Download the firmware file from the internet and extract the files of the Win Zip archive to the PC in use.
3. Switch off the Integrated SupplyCom module by disconnecting the power supply.
4. Establish a connection between the Integrated SupplyCom and the PC by means of a serial connection cable. The cable is connected to a COM port of the PC. The cable should be tightly connected on both ends.
5. Open the command prompt and start the flash tool by running the file COM_X.bat (X represents the number of the used COM port, e.g. COM_2.bat when connecting the module to the COM2 port of the PC).
   Alternatively, the flash tool can also run via following direct command:
   `flasher.exe -d "<file name>" -p <COM-Port-No>`
   e.g. for COM3: **`flasher -d "p&e_icd.s2" -p 3`**
6. Switch on the module by re-establishing the power supply. The loading process starts automatically. The flash tool must be started simultaneously with the restart of the power.
7. Wait for the loading process of the firmware. This can take a time between 30 seconds and 2 minutes. During the loading process the status LED flashes red. The flash tool may not put out an error message (e.g. verify error).
8. After a successful loading process, the module is automatically started with the new firmware and is immediately ready for operation.

Attention:

- As is the case with every flash process, the update entail a certain risk. So, only run the update if it is absolutely required for deleting existing compatibility problems or to allow new functions.
- The described procedure for updating the module to new firmware versions has been optimal tested and, provided the observance of this instruction, has been found save.
- As the manufacturer cannot accomplish the flash process himself, no liability can be assumed for resulting damages to the module or its functionality.

9.2 Used pin-designations

The designation of the signals on the digital pins has been selected according to the signals of the power supplies of Delta Elektronika. So, the logical allocation of the signals is supposed to be supported within the power supply profiles. As the designations are independent of the real function, they can be used deliberately.

Designation	Description	I/O
DIS	Disabled	–
ACF	AC-FAIL	IN
DCF	DC-FAIL	IN
LIM	CC Limit	IN

Designation	Description	I/O
OT	Over Temperature	IN
PSOL	PowerSink Overload	IN
CCS	CC State	IN
RSD	Remote ShutDown	OUT

10 Index