PSC 232

POWER SUPPLY CONTROLLER

RS 232 BUS COMPATIBLE

General

The PSC 232 is an interface box between a computer with RS232 BUS and an analog programmable power supply. The PSC 232 can program the output voltage, current and remote shut down and can read the monitor outputs (V and I) and status outputs (cc, ovp, ac-fail and thermal alarm) and communicate these back to the computer. The analog and logic in- and outputs are isolated from the RS232 BUS and earth. Up to 10 pieces PSC 232 can be connected in cascade. (See fig. 4). In that case each unit gets a unique channel number, chosen with the channel switch on the front panel. This allows the control of complex systems using only one RS232 BUS. The PSC 232 can be used with programming and monitor voltages 0-5 V or 0-10V selectable by internal switches.

Programming

The programming via the PSC 232 is very simple. The PSC 232 board's processor allows programming with text strings corresponding with SCPI (Standard Commands for Programmable Instruments). For example after the command MEASURE:VOLT? the PSC 232 will send the measured output voltage of the power supply to the computer.

Computer interface

RS232 BUS baud rate	: 4800 baud
Signal level	: +10V to -10V

Connectors

From PC	: D 9 F connector
To next PSC 232	: D 9 M connector

Analog in- / outputs

2 x Analog input	: 0-5V or 0-10V
2 x Input range adjustment	: +/- 5%
2 x Analog output	: 0-5V or 0-10V
2 x Output range adjustment	: +/- 5%
2 x Output offset adjustment	: +/- 45 mV
Output accuracy	: 0.5%
Resolution	: 12 bit
Linearity error	: 1 LSB
TC typical	: 50 ppm/°C
Maximum speed	: 200 steps / sec.

Analog in- and outputs have a common zero.

Logic in- / outputs

1 x Logic output	: remote shut down
5 x Logic input	: ovp, cc, therm, ac-fail, dc-fail

Logic in- and outputs have a common zero.
Logic high = 5 V, logic low = 0 V

Connector	: D 15 M connector
Insulation	: See fig. 1
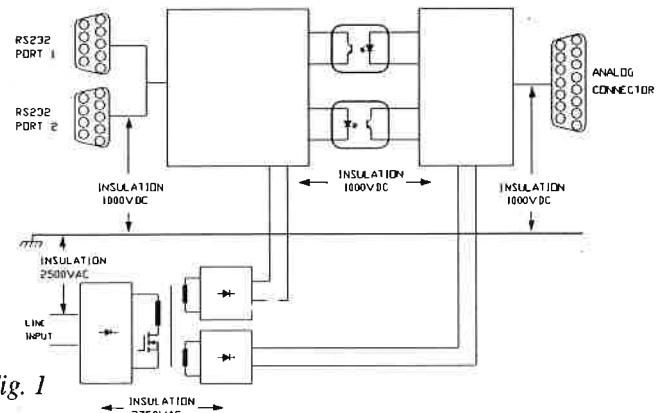
Fig. 1
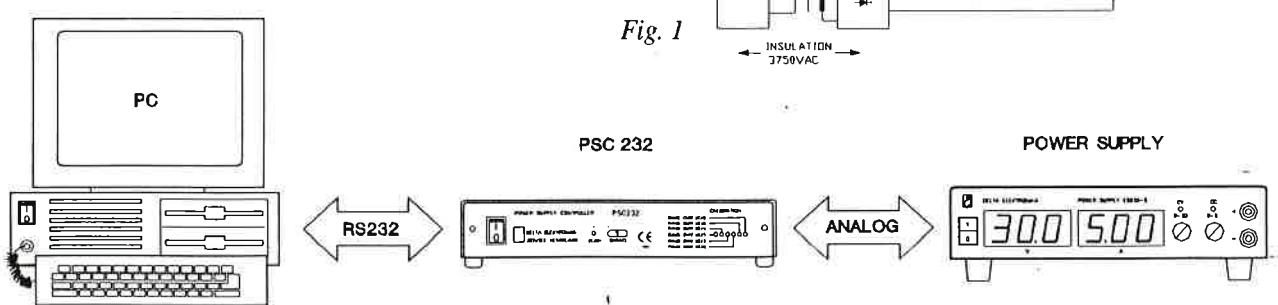
Fig. 2

Line input

Wide range 98 - 264 V AC 48 - 62 Hz
or 150 - 300 V DC.

Power consumption	:	3 watts
RFI suppression	:	VDE 0871 B
Insulation	:	See fig. 1

Hold up time   : 1 sec.

Ambient temperature

Operating 0 - 55 °C, storage -40 to +70 °C

EMC immunity

801-2 ESD	:	Level 3 air discharge
801-3 RF fields	:	Level 3, 10V/m
801-4 Bursts	:	Level 4
801-5 Surge	:	Level 4

Dimensions and weight

40 x 155 x 218 mm, 0.75 kgs

## Enclosure   : IP20
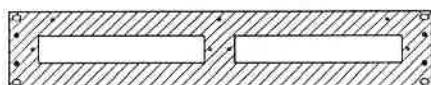
Accessories

Following is supplied with the PSC 232
- Line cord
- Analog cable 15M/15F
- RS 232 cable 9M/9F
- Adapter 25F/9M
- 3.5 inch diskette with example software
- Accessories for wall mounting
- Manual
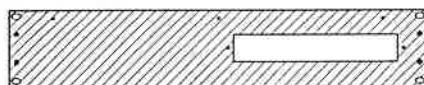
Mounting
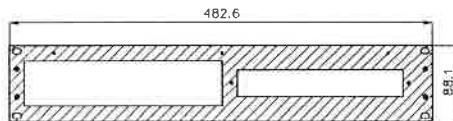
The PSC 232 is not only suitable for bench use but also for wall and 19 inch rack mounting. For rack mounting 3 models of 1U high front panels can be ordered. (See fig. 3)

19" adapter RA19-2RS
For horizontal 19" rack mounting
of 2 units PSC 232

19" adapter RA19-1RS
For horizontal 19" rack mounting
of 1 unit PSC 232

19" adapter RA19-ESRS
For horizontal 19" rack mounting
*of 1 model ES and 1 unit PSC 232*

Fig. 3
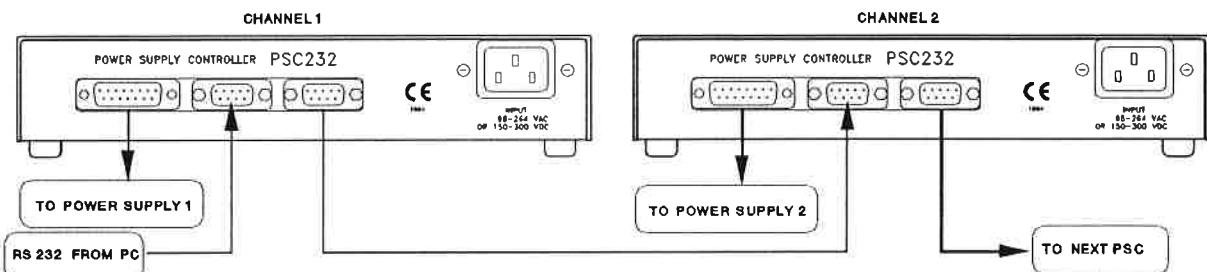
Fig. 4
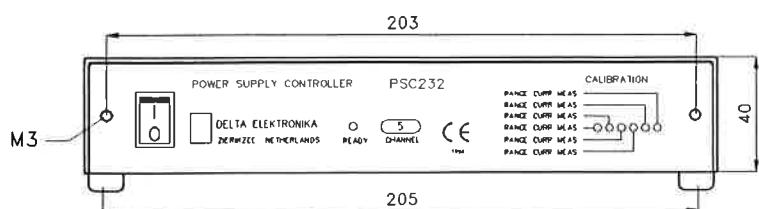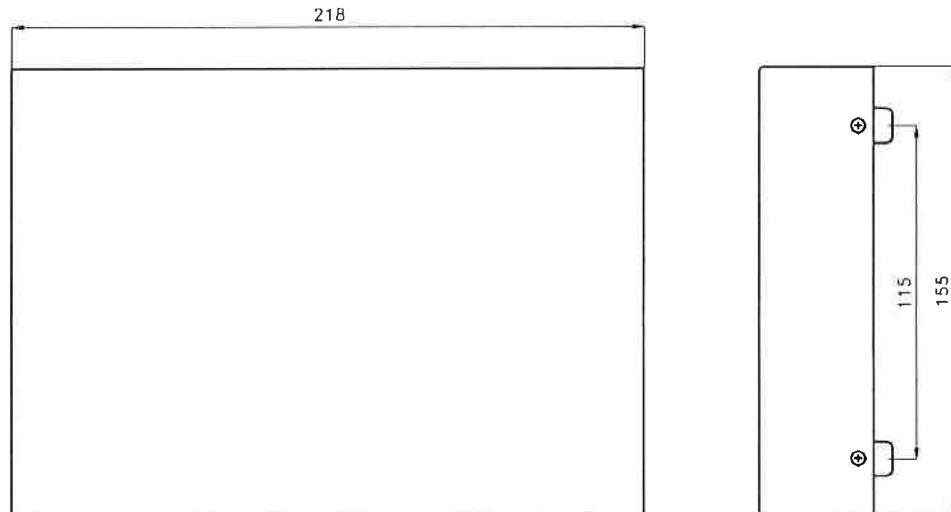
Fig. 5

INSTALLATION:

1 Use the RS232 cable with 9-pole D-connectors to connect the PC to the PSC232. If the computer has only a 25 pole RS232 port, the 25F/9M adapter supplied with the PSC232 can be used.
2 Connect the analog cable with the 15-pole D-connectors between the PSC232 and the power supply.
3 Connect the line cord between the PSC232 and any line voltage between 98 and 264V AC or 150 and 300VDC.
4 Put the two 'manual/program' switches at the rear side of the power supply in position 'prog'.
5 Select the channel with the channel switch on the frontpanel of the PSC232.
6 Programming instructions and examples are on the supplied 3.5 inch diskette.

COMMAND DESCRIPTION:

Help?
The Help? command will display a table with commands of the PSC232.

```
        COMMAND LIST
--------------------------
CH <x>
CH?
SOurce:Voltage:Maximum <x>
SOurce:Current:Maximum <x>
SOurce:Voltage <x>
SOurce:Current <x>
Measure:Voltage?
Measure:Current?
SOurce:Function:Rsd <ON|OFf>
SOurce:Function:Rsd?
SEnse:Digital:Data?
Route:Terminal <Front|None>
*Rst
*Idn?
Help?
```

NOTE:
Most of the PSC's commands can be abbreviated. The abbreviations are shown in capitals in the command list above. For example: the SOurce:Voltage:Maximum <x> command can be entered as SO:V:M <x> or as so:v:m <x>.

Each command should be terminated with LF (line feed) or LF+CR (carriage return)

LF   = ASCII CHR 10 = ^J
CR   = ASCII CHR 13 = ^M
EOT = ASCII CHR 4   After each message the PSC232 will send an EOT character
SP   = space
ESC = ASCII CHR 27 = ^[Use the ESC character to cancel the current command and reset the PSC232 to accept a new command.

CHANNEL COMMAND:

The channel command *CH <x>* is the first command that should be executed to enable the PSC232 with that channel number. Each unit must have a unique channel number minimum 0 and maximum 9.
The channel can be set with the channel switch on the front panel *(See fig.6)*. The PSC232 units can be connected in cascade up to 10 units and allow the control of complex systems, using a computer with

only one RS232 port *(See fig.4)*. After the command *CH 5* only the PSC with the channel selector set at 5, will execute all the following commands.

The command *CH?* reads the channel number of the active PSC232 and communicates this back to the computer.

CHANNEL SWITCH
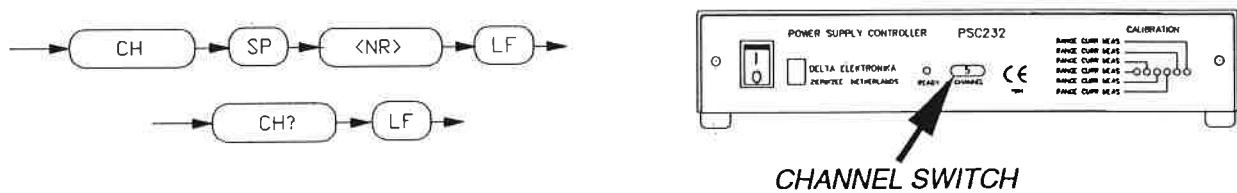
Fig. 6

RANGE and SET COMMAND:
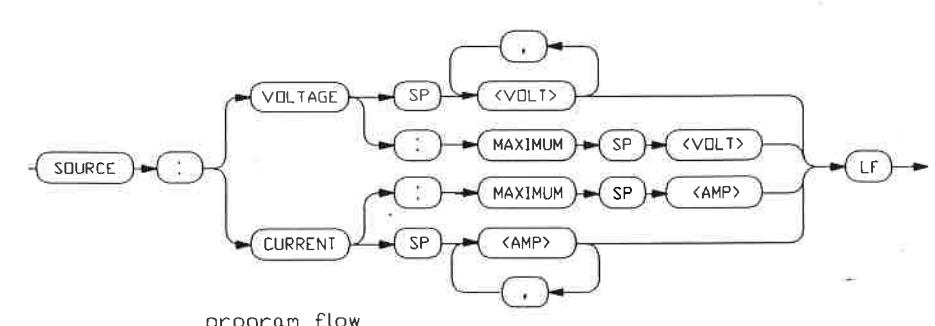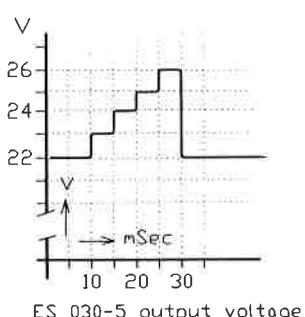
The *SOurce:Voltage:Maximum <volt>* and the *SOurce:Current:Maximum <amp>* commands enter the maximum voltage and current range of the power supply. These commands have to be given before the voltage and current set commands. The maximum value for input is 650. For example, the Delta power supply model ES 030-5 has a range of 30 V and 5 A. Send the string *"SOurce:Voltage:Maximum 30"* and *"SOurce:Current:Maximum 5"* from the PC to the PSC232. The PSC232 saves this value in the micro processor RAM memory. Then send the string *"SOurce:Current 2.3"* and the string *"SOurce:Voltage 18.5"*. Now the power supply output voltage is 18.5 V in the constant voltage mode and the current limit is 2.3A. To change the Voltage from 18.5 to 22V send the string *"SOurce:Voltage 22"*. Note that both voltage and current have to be programmed. It is necessary that the values of both current and voltage are non zero.

Example: *SOurce:Voltage 22* or abbreviated **SO:V 22** or for a special voltage or current shape: **SO:V 22,23,24,25,26,24** *(see BASIC example and diagram)*. In this way it is possible to change the voltage or current very fast.

```
100 REM GWBASIC EXAMPLE
110 OPEN "com1:4800,n,8,1,cs,ds" FOR OUTPUT AS #1
120 PRINT #1, "CH 5"
130 PRINT #1, "SOURCE:VOLT:MAXI 30"
140 PRINT #1, "SOURCE:CURR:MAXI 5"
150 PRINT #1, "SOURCE:CURR 2.3"
160 PRINT #1, "SOURCE:VOLT 22,23,24.25,26,22"
170 CLOSE
```


ES 030-5 output voltage

program flow
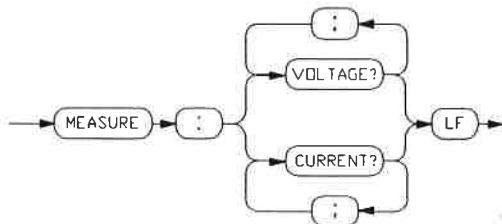
READ BACK COMMAND:

Measure:Voltage? or abbreviated **M:V?**
Use Measure:Voltage? and Measure:Current? to measure the power supply output voltage and output current.
The PSC232 sends the values of voltage and current to the computer.

```
                           ┌──────( : )◄─────┐
                           │                 │
                     ┌───►(VOLTAGE?)──────────┤
                     │                        │
 ──►(MEASURE)──►( : )─┤                        ├──►( LF )──►
                     │                        │
                     └───►(CURRENT?)──────────┤
                           │                 │
                           └──────( : )◄─────┘
```
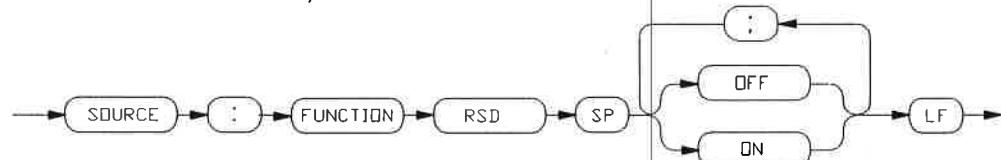
REMOTE SHUT DOWN:

The logic output of the PSC232 can be used to shut down the power supply. When the command
SOurce:Function:Rsd ON or abbreviated **SO:F:R ON** is sent, the voltage on pin 5 of the 15P D-connector goes to logic high and shuts down (disables) the power supply output. The command
SOurce:Function:Rsd OFf or abbreviated **SO:F:R OF** gives zero at pin 5 which enables the output voltage and output current.
The command *SO:F:R?* reads the RSD status of the active PSC232 and communicates this back to the computer.
0 = remote shut down off, 1 = remote shut down on.

```
                                            ┌─────( : )◄─────┐
                                            │                │
                                       ┌───►( OFF )──────────┤
 ──►(SOURCE)──►( : )──►(FUNCTION)──►(RSD)──►(SP)─┤                ├──►( LF )──►
                                       │                │
                                       └───►( ON )──────────┘
```

READ BACK SIGNAL STATUS:

With the command **SEns:Digital:Data?** or abbreviated **SE:D:D?** the PSC232 reads the logic status outputs of the power supply.
The PSC232 sends a decimal status code to the computer corresponding with:
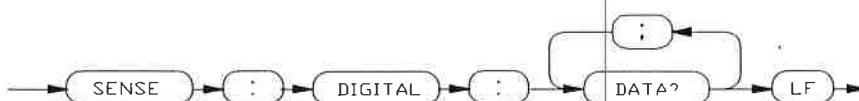
bit	function	decimal value
0	Constant current signal	1
1	Over voltage protection signal	2
2	DC output fail signal	4
3	Line input fail signal	8
4	Thermal alarm signal	16

For bit 2,3 and 4 see the power supply manual if supported
The response data format is a decimal number from 0 - 31.
A combination of functions results in a sum of the decimal values.
For example: 'Constant current signal' and 'Thermal alarm signal' gives 1 + 16 = 17.

```
                                      ┌─────( : )◄─────┐
                                      │                │
 ──►(SENSE)──►( : )──►(DIGITAL)──►( : )─┴──►(DATA?)──────┴──►( LF )──►
```
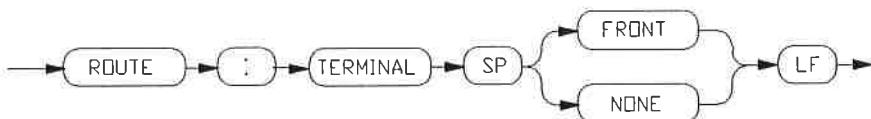
TERMINAL MODE:

After the command *Route:Terminal Front or* abbreviated *R:T F* the PSC232 is in the terminal mode and the computer displays a table with the last set value and functions.

```
Source Channel  = 3
Range Voltage   = 30
Range Current   = 5
Set. Voltage    = 22
Set. Current    = 2.3
Meas. Voltage   = 22
Meas. Current   = 2.3
Rem. Shut Down  = 0
Signal Status   = 0
```

After the command *Route:Terminal None* or abbreviated *R:T N* the PSC232 is in the program mode and only returns a value after questionmark commands. Use the windows terminal program and open A:\WIN\ES030_5.TRM from the supplied 3.5 inch diskette and see how the buttons are programmed.

RESET THE PSC232

The *Rst or *R command resets to the power on state.

IDENTIFY:
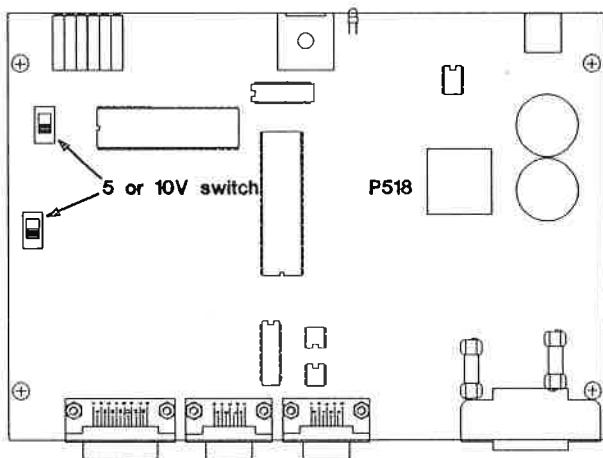
The *IDN? or *I? command will return type and version etc. of the PSC232.

```
PSC232 V1.0
DELTA ELEKTRONIKA
ZIERIKZEE
```

SWITCH 0 -5 / 0 - 10 V:

The analog in- and outputs can be changed from 0-5V to 0-10V with two internal switches, one for the programming voltage and one for the measured voltage.

WARNING: Before removing the cover (4 screws in the cover) disconnect the AC line input, and wait 1 min.


9F pole D-connector 9M pole D-connector

-------- SPECIFICATIONS: ----------------------

COMMUNICATIONS RS232 port:
Baud rate	: 4800
Data bits	: 8
Stopbits	: 1
Parity	: none
Flow control	: none
Signal level	: +10V to -10V
Max. cable length	: 15m (shielded)
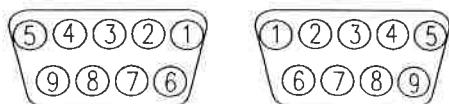
Pin assignment and signal names of the 9F pole D-connector:
Pin 2 = TXD
Pin 3 = RXD   (to PC)
Pin 5 = GND

Pin assignment and signal names of the 9M pole D-connector:
Pin 2 = RXD
Pin 3 = TXD   (to next PSC232)
Pin 5 = GND

Pin configuration of the 15-pole D-connector

Analog in- and outputs have a common zero on pin 1.
Logic in- and outputs have a common zero on pin 8.
Pin 1 = analog common
Pin 2 = current monitor analog input
Pin 3 = current program analog output
Pin 4 = constant current signal logic input
Pin 5 = remote shut down logic output
Pin 8 = logic common
Pin 10 = voltage monitor analog input
Pin 11 = voltage program analog output
Pin 13 = over voltage protection signal logic input*
Pin 14 = over temp alarm signal logic input*
Pin 15 = power fail alarm signal logic input *

* = only if supported by the power supply
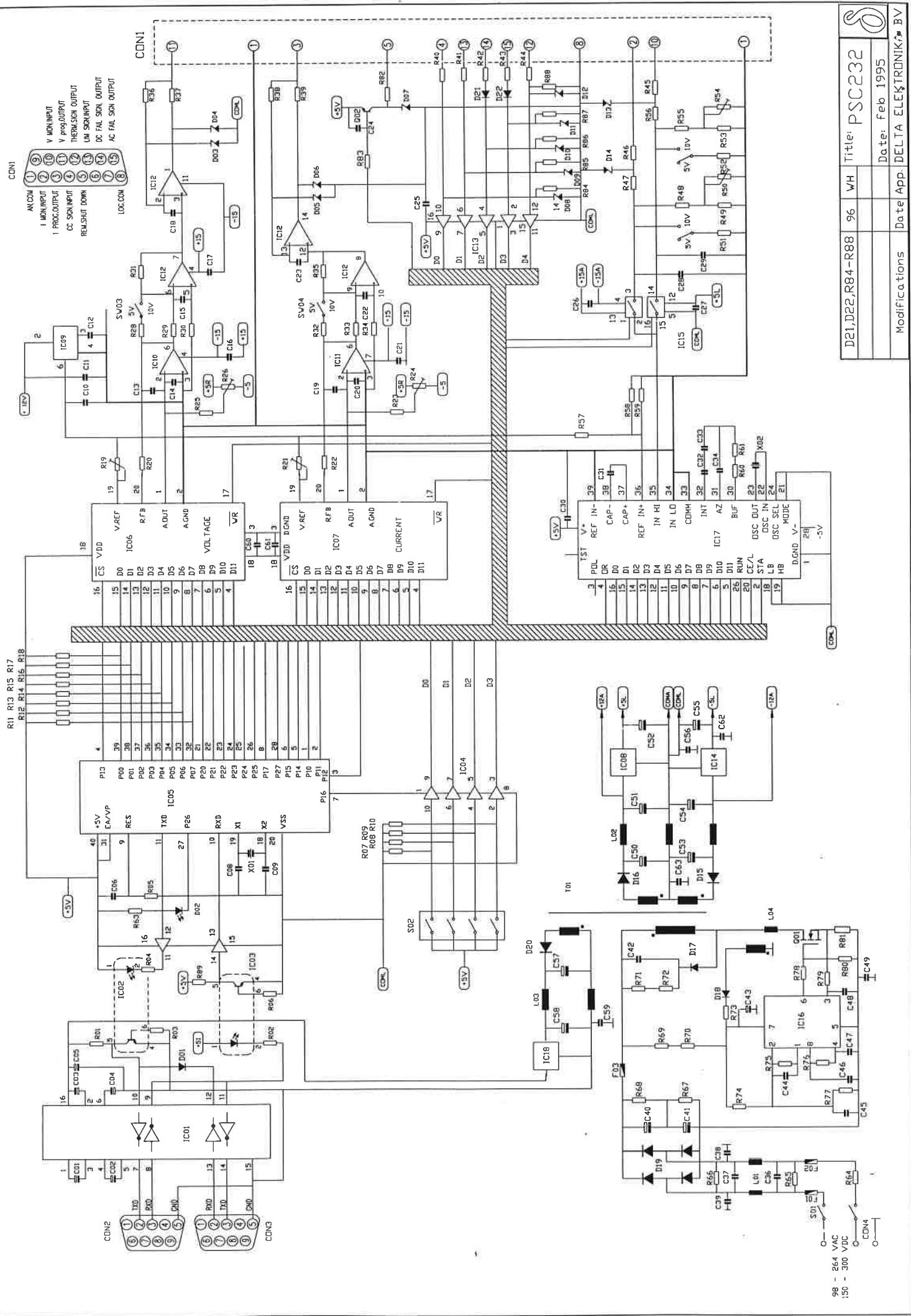
15M pole connector
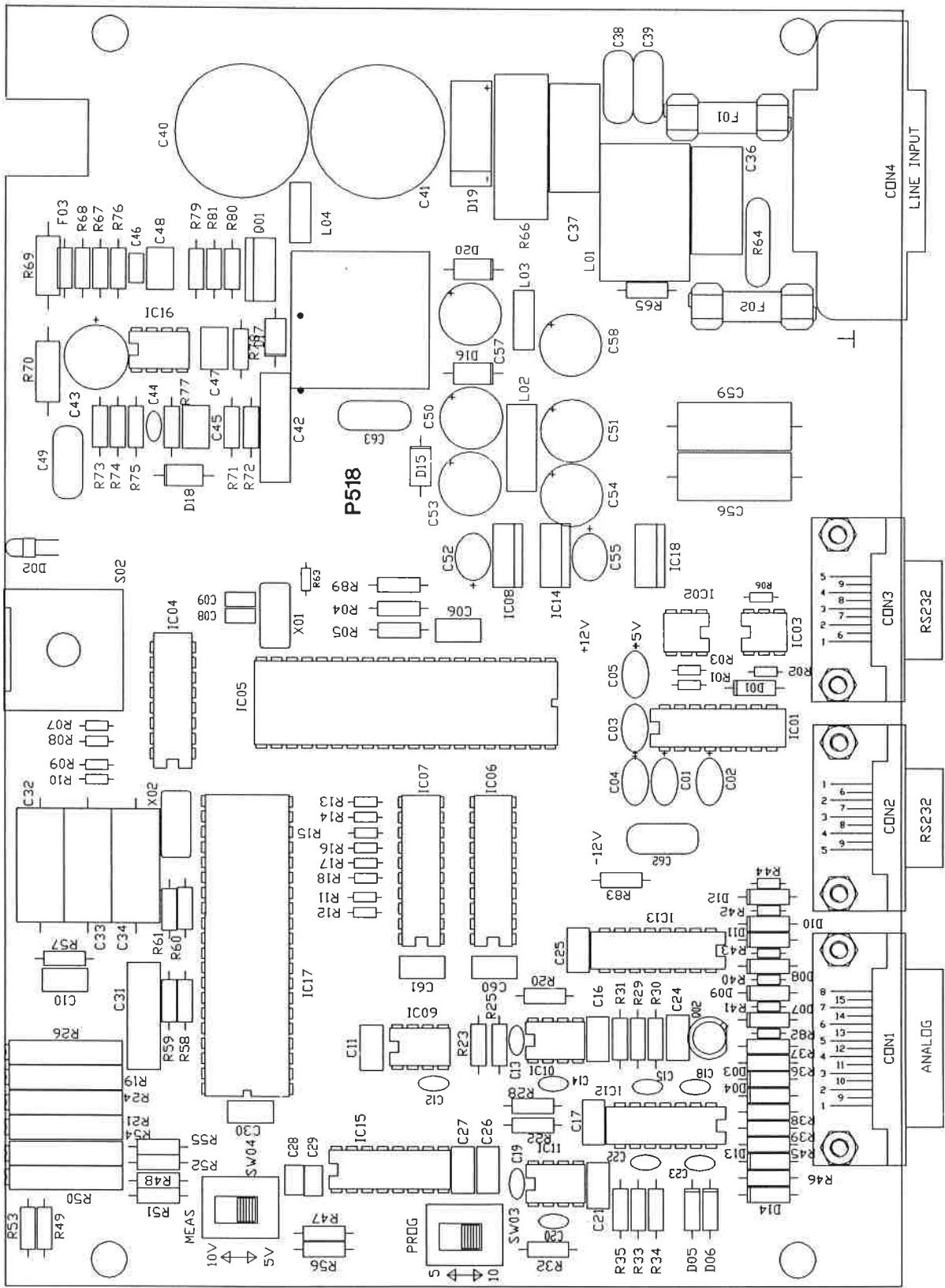
LED INDICATOR:
The green LED on the frontpanel indicates that the PSC232 is ready to receive a command.
It is normal that the led blinks when a signal is received.
When the LED is off continuously, the following errors are possible:
1) The line voltage is too low or absent.
   Check the line voltage.
2) The interpreter receives an invalid command.
   Send a ESC.
3) The computer's baudrate is not set to 4800 Baud
4) The RS232 cable is too long.

This schematic diagram titled "PSC232" by DELTA ELEKTRONIKA BV, dated Feb 1995.

Title block information:
- Title: PSC232
- Date: Feb 1995
- App.: DELTA ELEKTRONIK BV
- Modifications: D21,D22,R84-R88 | 96 | WH | Date

CDN1 connector labels:
- AN.COM
- V MON.INPUT
- I MON.INPUT
- V prog.OUTPUT
- I PROC.OUTPUT
- THERM.SIGN OUTPUT
- CC SIGN.INPUT
- I/M SIGN.INPUT
- DC FAIL. SIGN. OUTPUT
- REM.SHUT DOWN
- AC FAIL. SIGN. OUTPUT
- LOC.COM

Input voltage ratings:
- 98 - 264 VAC
- 150 - 300 VDC

PSC232

Title: PSC232
Date: FEB 1995 App. DELTA ELEKTRONIKA BV
WH
Date App.
Modifications

LINE INPUT
CON4

P518

RS232 CON3
RS232 CON2
ANALOG CON1

PSC232

Ref	Value	Type/Mfr
C01	= 2.2UF 25V	SOLID ALU
C02	= 2.2UF 25V	SOLID ALU
C03	= 2.2UF 25V	SOLID ALU
C04	= 2.2UF 25V	SOLID ALU
C05	= 2.2UF 25V	SOLID ALU
C06	= 330NF 50V	MULT LAY
C08	= 22PF 100V	MULT LAYR
C09	= 22PF 100V	MULT LAYR
C10	= 330NF 50V	MULT LAY
C11	= 330NF 50V	MULT LAY
C12	= 15PF 500V	CERAMIC
C13	= 15PF 500V	CERAMIC
C14	= 15PF 500V	CERAMIC
C15	= 15PF 500V	CERAMIC
C16	= 330NF 50V	MULT LAY
C17	= 330NF 50V	MULT LAY
C18	= 15PF 500V	CERAMIC
C19	= 15PF 500V	CERAMIC
C20	= 15PF 500V	CERAMIC
C21	= 330NF 50V	MULT LAY
C22	= 15PF 500V	CERAMIC
C23	= 15PF 500V	CERAMIC
C24	= 330NF 50V	MULT LAY
C25	= 330NF 50V	MULT LAY
C26	= 330NF 50V	MULT LAY
C27	= 330NF 50V	MULT LAY
C28	= 47NF 100V	MULT LAYR
C29	= 47NF 100V	MULT LAYR
C30	= 330NF 50V	MULT LAY
C31	= 1UF 63V	MET POLYES
C32	= 0.33UF 250V	MET POLYES
C33	= 0.33UF 250V	MET POLYES
C34	= 0.33UF 250V	MET POLYES
C36	= 0.1UF 250V RMS	X2
C37	= 0.1UF 250V RMS	X2
C38	= 2200PF 400V RMS	SAFETY
C39	= 2200PF 400V RMS	SAFETY
C40	= 100UF 200V	
C41	= 100UF 200V	
C42	= 680PF 2000V	POLYPROP
C43	= 100UF 35V	PHILIPS
C44	= 100PF 500V	CERAMIC
C45	= 2200PF 100V	POLYPROP
C46	= 0.01UF 100V	MULT LAYER
C47	= 2200PF 100V	POLYPROP
C48	= 2200PF 100V	POLYPROP
C49	= 2200PF 400V RMS	SAFETY
C50	= 220UF 35V	ERO
C51	= 220UF 35V	ERO
C52	= 33UF 10V	SOLID ALU
C53	= 220UF 35V	ERO
C54	= 220UF 35V	ERO
C55	= 33UF 10V	SOLID ALU
C56	= 68NF 250V RMS	X2
C57	= 220UF 35V	ERO
C58	= 220UF 35V	ERO
C59	= 68NF 250V RMS	X2
C60	= 330NF 50V	MULT LAY
C61	= 330NF 50V	MULT LAY
C62	= 2200PF 400V RMS	SAFETY
C63	= 2200PF 400V RMS	SAFETY
CON1	= CONN 15P D M	TH&BETTS
CON2	= CONN 09P D F	TH&BETTS
CON3	= CONN 09P M	TH&BETTS
CON4	= LINE SOCKET	
D01	= 1N4148	PHILIPS
D02	= LED 3MM GREEN	
D03	= BZX55-C12	ITT
D04	= BZX55-C12	ITT
D05	= BZX55-C12	ITT
D06	= BZX55-C12	ITT
D07	= BZX55-C5V6	ITT
D08	= BZX55-C5V6	ITT
D09	= BZX55-C5V6	ITT
D10	= BZX55-C5V6	ITT
D11	= BZX55-C5V6	ITT
D12	= BZX55-C5V6	ITT
D13	= BZX55-C12	ITT
D14	= BZX55-C12	ITT
D15	= BYV26B	PHILIPS
D16	= BYV26B	PHILIPS
D17	= BYV26D	PHILIPS
D18	= BYV26B	PHILIPS
D19	= SKB2-12L5A	SEMIKRON
D20	= BYV26B	PHILIPS
D21	= 1N5060	
D22	= 1N5060	
F01	= FUSE 5X20 1T	
F02	= FUSE 5X20 1T	
F03	= FUSE PICO 0.25F	
IC01	= ICL 232 CPE	HARRIS
IC02	= 4N26	MOTOROLA
IC03	= 4N26	MOTOROLA
IC04	= 4503	HARRIS
IC05	= D87 C51	INTEL
IC06	= AD7545JN	HARRIS
IC07	= AD7545JN	HARRIS
IC08	= L7805CV	ST
IC09	= REF02HP	
IC10	= OP27 EP	AD
IC11	= OP27 EP	AD
IC12	= TL084BCN	TEXAS
IC12	= TL084BCN	TEXAS
IC13	= 4503	HARRIS
IC14	= L7905CV	ST
IC15	= DG445DJ	HARRIS
IC16	= UC3842	UNITRODE
IC17	= 7109	HARRIS
IC18	= L7805CV	ST
L01	= 2X39MH 0.5A	THAILIN
L02	= XL443	DELTA
L03	= XL444	DELTA
L04	= XL448	DELTA
Q01	= BUK446-800A	PHILIPS
Q02	= 2N2907A	PHILIPS
R01	= 10K	MF/0.4W/250V
R02	= 475R	MF/0.4W/250V
R03	= 100K	MF/0.4W/250V
R04	= 475	MF/0.6W/350V
R05	= 1M	MF/0.25W/1600V
R06	= 100K	MF/0.4W/250V
R07	= 10K	MF/0.4W/250V
R08	= 10K	MF/0.4W/250V
R09	= 10K	MF/0.4W/250V
R10	= 10K	MF/0.4W/250V
R11	= 10K	MF/0.4W/250V
R12	= 10K	MF/0.4W/250V
R13	= 10K	MF/0.4W/250V
R14	= 10K	MF/0.4W/250V
R15	= 10K	MF/0.4W/250V
R16	= 10K	MF/0.4W/250V
R17	= 10K	MF/0.4W/250V
R18	= 10K	MF/0.4W/250V
R19	= 1K	TRIMPOTM 20 TURNS
R20	= 475	MF/0.6W/350V
R21	= 1K	TRIMPOTM 20 TURNS
R22	= 475	MF/0.6W/350V
R23	= 1M	MF/0.25W/1600V
R24	= 10K	TRIMPOTM 20 TURNS
R25	= 1M	MF/0.25W/1600V
R26	= 10K	TRIMPOTM 20 TURNS
R28	= 10K	MF/0.6W/350V
R29	= 10K	MF/0.6W/350V
R30	= 10K	MF/0.6W/350V
R31	= 10K	MF/0.6W/350V
R32	= 10K	MF/0.6W/350V
R33	= 10K	MF/0.6W/350V
R34	= 10K	MF/0.6W/350V
R35	= 10K	MF/0.6W/350V
R36	= 100	MF/0.6W/350V
R37	= 100	MF/0.6W/350V
R38	= 100	MF/0.6W/350V
R39	= 100	MF/0.6W/350V
R40	= 1K	MF/0.4W/250V
R41	= 1K	MF/0.4W/250V
R42	= 1K	MF/0.4W/250V
R43	= 1K	MF/0.4W/250V
R44	= 1K	MF/0.4W/250V
R45	= 18.2K	MF/0.6W/350V
R46	= 18.2K	MF/0.6W/350V
R47	= 100K	MF/0.6W/350V
R48	= 10K	MF/0.6W/350V
R49	= 2.21K	MF/0.6W/350V
R50	= 1K	TRIMPOTM 20 TURNS
R51	= 10K	MF/0.6W/350V
R52	= 10K	MF/0.6W/350V
R53	= 2.21K	MF/0.6W/350V
R54	= 1K	TRIMPOTM 20 TURNS
R55	= 10K	MF/0.6W/350V
R56	= 100K	MF/0.6W/350V
R57	= 10K	MF/0.6W/350V
R58	= 475	MF/0.6W/350V
R59	= 5.62K	MF/0.6W/350V
R60	= 100K	MF/0.6W/350V
R61	= 100K	MF/0.6W/350V
R63	= 1K	MF/0.4W/250V
R64	= NTC 33	THOMS
R65	= 1M	MF/0.25W/1600V
R66	= TNR23G471K	MARCON
R67	= 150K	MF/0.6W/350V
R68	= 150K	MF/0.6W/350V
R69	= 39K	MF/2.0W/500V
R70	= 39K	MF/2.0W/500V
R71	= 47.5K	MF/0.6W/350V
R72	= 47.5K	MF/0.6W/350V
R73	= 6.81	MF/0.6W/350V
R74	= 68.1K	MF/0.6W/350V
R75	= 681K	MF/0.6W/350V
R76	= 8.25K	MF/0.6W/350V
R77	= 15K	MF/0.6W/350V
R78	= 15	MF/0.6W/350V
R79	= 221	MF/0.6W/350V
R80	= 22.1K	MF/0.6W/350V
R81	= 3.92	MF/0.6W/350V
R82	= 10R	MF/0.4W/250V
R83	= 10K	MF/0.6W/350V
R84	= 56.2K	MF/0.4W/250V
R85	= 56.2K	MF/0.4W/250V
R86	= 56.2K	MF/0.4W/250V
R87	= 56.2K	MF/0.4W/250V
R88	= 56.2K	MF/0.4W/250V
R89	= 10K	MF/0.6W/350V
S01	= SWITCH DPDT 4A RCK	
S02	= SITCH SPCW BCD	C&K
SW03	= SWITCH DPDT 6A SLD	
SW04	= SWITCH DPDT 6A SLD	
T01	= XT439	DELTA
X01	= XTAL 12MHZ	IQD
X02	= XTAL 3.579MHZ	IQD

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