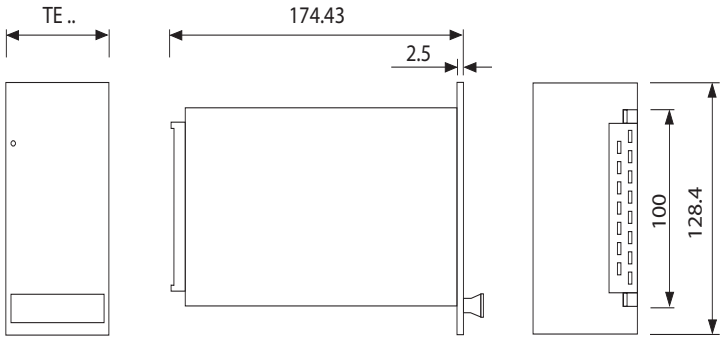
- 150 watts output power
- 19“ plug-in module 3U / 8HP
- Wide range input
- Active power factor correction (PFC)
- For n + 1 redundancy operation
- Hot-Swap
- Modern microcontroller technology
- Digital interface (LIN 1.3 / opt.RS485)
- Thermal Load-share or optional Load-share with interface
- Operating data with interface readable (Vo / Io / temperature / status)
- Common, programmable signal output for: Power-Fail (PF), AC-Fail (ACFAIL) and temp alert



C US
CSA 22.2 No. 60950-1-03
UL Std. 60950

CB scheme certified
SI-2377

3 Years guarantee!

3U

Front panel: 8HP - 40,3
Handle width: 3HP

ORDER DATA				ORDER NUMBERS
Vo V	**Io A**	**Width HP**	**Height U**	**Type-No.**
5.1	0 - 30	8	3	**P140R-0530** *15.9243.300*
7.5	0 - 20	8	3	**P140R-0720** *15.9246.200*
12 - 15	0 - 12.5 / 0 - 10	8	3	**P140R-1212** *15.9243.700*
24	0 - 6.3	8	3	**P140R-2406** *15.9244.100*
48	0 - 3.2	8	3	**P140R-4803** *15.9244.500*
Additionally:				
Front panel (natural anodized)				*33.1592.014.011*
Assembly kit for DIN-rail				*15.7140.000.190*
Assembly kit for wall mounting				*15.7140.000.290*
LIN-Busmastercard LIN -> PMBus -> RS232 (3U/4HP)				*on enquiry*

For Hot-Swap operation, there must be a breaktime (1 minute), because the input current inrush.

Ventilation from bottom to top of the power supply and the housing-specific heatradiation must not be obstructed when installing the power supply.

Ensure fire protection by means of the surrounding housing system.

AC / DC POWER SUPPLY
PRIMARY SWITCHED · SINGLE OUTPUT
P140R SERIES

1. INPUT

AC input range	100-240Vac ±10%, 50-60 Hz
	-15% with fan cooling
Efficiency	80-85% typ.
Input current limitation	< 30 A_{peak} typ. - in cold state
	< 40 A_{peak} typ. - in hot state
Internal fuse	4AT

2. OUTPUT

Adjustment range Vo	5V/7.5V/24V/48V-type: -5/+10%
	12V-type: -5/+37%
Max. output power	150W with fan cooling ≥ 1.5m/s
Operation indicator	green LED for Ua / AC good
	red LED for Ua / AC / Temp. fail
Ripple	< 0.6% V_{nom} (150 KHz band width)
Noise voltage	< 1.0% V_{nom} (20 MHz band width)
Temperature coefficient	≤ 0.055% / K
switch performance	No overshooting of Vo (soft start)
Start-up delay	approx. 1s (Hot-Swap-Delay)
Rise time	10 ms typ.

3. REGULATION

Line regulation	< 0.1% for Vo bei Vi_{min} - Vi_{max}
Load regulation	< 0.5% for Io 26 - 100% I_{nom}
	< 0.5-2% for Io 0 - 26% I_{nom}
Response time	1ms typ. at Io 20 - 80% Inom

4. PROTECTION AND CONTROLLING

Overvoltage protection	120% ± 5% Vo
Current limitation	105% Inom typ. (at 12V-type depends on Vo), straight characteristic
	Output permanent short-circuit proof,
	at 48V-type: hicup-mode at Vo<1V_{DC}
Overtemperature protection	Switches in stand by mode, if inside temperature becomes to high
Mains buffering	≥ 20ms at 100% Load and Vi=115Vac
Signal output	Transistor output (low activ)
	max. 60V/100mA with internal
	pull-up-resistor to Vo
PF-signal threshold	<85% Vo or >115% Vo (± 1%)

5. EMC

Harmonics (PFC)	EN61000-3-2 (Class A)	
EMC Immunity	EN61000-6-2 / EN61204-3	
Electrostatic discharge	EN61000-4-2	8/15KV
Electromagnetic RF field	EN61000-4-3	10V/m
Fast transients (Burst)	EN61000-4-4	4KV/2 KV
Surge (input / output)	EN61000-4-5	4KV/0.5KV (unsym.)
RF field conducted induced	EN61000-4-6	10V
Mains voltage dips	EN61000-4-11	
EMC Emission	EN61000-6-3 / EN61204-3	
	EN55011 Class B	
	Radiation depends on assembly	
Flicker	EN61000-3-3	

6. SAFETY

	IEC 60950-1:2005 DIN EN 60950-1:2006
	CSA 22.2 Nr. 60950
	Safety class 1, VDE 0100

7. OPERATING DATA

Temperature range	-25...70°C
Derating	2.5%/K from +50°C with fan cooling
	2.5%/K from +35°C without fan cooling
Weight	1.2 kg
PFC	Active PFC, cos φ >0.95
Parallel connection	Yes

Ventilation from bottom to top of the power supply and the housing-specific heatradiation must not be obstructed when installing the power supply. Ensure fire protection by means of the surrounding housing system.

8. MECHANICS

Dimensions	19“ plug-in module according to DIN41494
	3 U / 8 HP - Plug-in by PCB
Line Connection	H15 male connector DIN41612

PIN CONNECTIONS

H15 DIN41612

30	26	22	18	14	10	6
N	n.c.	Bus*	-L	-L	-L	-L

32	28	24	20	16	12	8	4
PE ⏚	L1	PF/AC* FAIL	ADR* SD	+SBS*	+L	+L	+L

9. EXPLANATION

PE ⏚	**Protective conductor**
	Do not use without PE-connection!
L1 / N	Mains phase / neutral conductor
+L / -L	Load connections (max. 14A / pin)

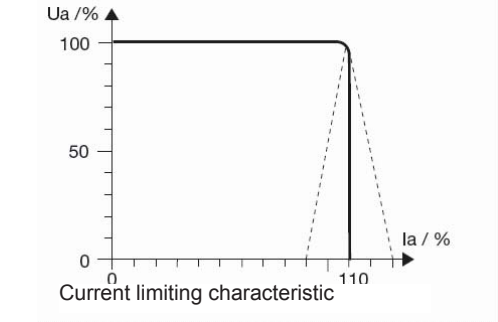
Connection optional:

PF/ACFAIL*	Signal output power- and AC-Fail
+SBS*	Stand by voltage
ADR*	Adress LIN-BUS (Slave-resistor)
SD*	Shut-down (connect to -L)
Bus*	Digital bus interface (LIN 1.3)

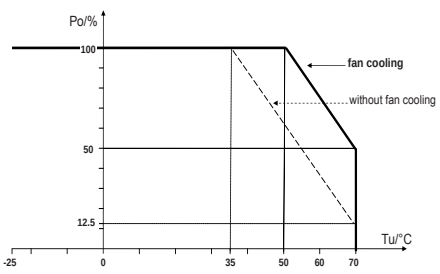
*** If you need more details, please contact MGV.**
Please note: The signal outputs are not short-circuit- and over-voltage-proof.

safety information www.mgv.de

Please refer to the MGV user instructions before use! (also in Internet www.mgv.de)



Current limiting characteristic



Derating

Extended Manual for the P140R Series

Contents

1. Product description

1.1 Functional description

The outstanding advantage of the P140R series is its combination of MGV's proven design of switching power supplies with the flexibility of micro-controllers. In fact, the P140R series uses two microcontrollers on each side of the galvanic separation for various control and monitoring tasks.
For more details, please refer to the data sheet of the P140R series (see Reference [1]).

1.2 Indicators and controls

To unambiguously display its internal status, the P140R series uses two light emitting diodes (LEDs).

- The lower LED is green and called the STATUS LED. The table below explains the meaning of the STATUS LED signals:

STATUS LED	Meaning	Condition / Description
always on	ON	Normal operation
blinking 50 ms off 1000 ms on	ON	Unit is a LIN slave, but there was no LIN master detected. See chapter 2 and Appendix 1 for more details.
blinking 1000 ms off/on	Stand-by or ON	Calibrate and Test mode
blinking 1250 ms off 25 ms on	Stand-by	The power supply is not ready for operation (hardware error detected)
blinking 1000 ms off 50 ms on	Stand-by	The power supply is not ready for operation (Stand-by regulator or redundancy failure)
blinking 50 ms off 500 ms on	Stand-by	Shut-down (output voltage is off) because of an ADR input or a LIN command
blinking 1000 ms off 500 ms on	Stand-by or OFF	Primary fault (other than over-temperature)
always off	OFF	Input voltage out of range or fault in the primary circuit of the unit
blinking 500 ms off 50 ms on	ON or Stand-by	Primary or secondary circuit is over temperature

- The upper LED is called the ERROR LED. If this LED lights up in red continuously, the power supply does not work correctly and its output does not provide the correct voltage. The table below explains the meaning of the ERROR LED signals:

ERROR LED	Meaning	Condition / Description
always off	ON	Normal operation (no error)
always off	OFF	Input voltage out of range or fault in the primary circuit of the unit
blinking or continuously on	Stand-by	Output power fail (output voltage is out of the specified range) – Shut-down because of an internal error, or an ADR input or a LIN command

- Setting the output voltage
  The output voltage of the power supply can be set either using the two buttons on the front panel or via the bus interface (see chapter 2).
  In order to set the output voltage to an exact value, we strongly recommend to continuously measure the output voltage of the unit with the help of an accurate voltmeter.
  When you push the upper button for a short moment, the output voltage of the unit increases by a small amount. When you push the lower button, the output voltage of the unit decreases by the same small amount.
  This small amount depends on the nominal output voltage of the unit and varies between some 10 mV and some 100 mV.
  When you push any of the two buttons for more than 1 second, the output voltage of the unit increases / decreases by this small amount every 50 ms.
  If you do not touch any button for a minimum of five seconds, the set voltage will be memorised internally.

1.3 Control inputs and status signals

- Pin 20 (**ADR/SD)** of the H15 connector on the back of the unit is a conventional shut-down control input (ON/OFF). When you connect this input with the output ground (-L), the output voltage is switched off.
  Important note:
  At this **ADR/SD** control input, there is an internal 10 kOhm pull-up resistor against the micro-controllers +5 V supply. Continuous or massive over-voltage on the input, as well as any current infeed, may lead to malfunction or permanent damage of the unit.

- Internal monitoring tasks generate a conventional status signal at Pin 24 (**PF/ACFAIL**) of the H15 connector. This is an open-collector transistor with a pull-up resistor against the output voltage (+L). The transistor becomes conductive when the ERROR LED lights up in red. The following status signals are available (all of them are active by default at the time of shipping):
  Power-Fail (**PF**):
  The signal transistor becomes conductive, when the output voltage is out of range. As long as the output voltage is in range (85%....115% (±1,5%) of the nominal voltage)*, the transistor is off.
  (Version -1212, range 12 V -15%±1,5% to 15 V +15%±1,5%)
  AC-Fail(**ACFAIL**):
  The transistor becomes conductive at least 10 ms before the output voltage drops.
  Over-temperature pre-alarm (**OTPA**):
  The transistor becomes conductive at least 10 s before the output voltage is switched off.

Via the bus interface (see chapter 2), you can activate or de-activate any status signal. Please note that all status signals activated are combined by a logical OR.

Important Notes

- **When there is no primary supply available (input voltage out of range or physically disconnected), there is no power supply for the status signal transistor mentioned above.**
- **When you connect several units in parallel, the status signal following a signal event is indeterminate. Therefore, trigger on the signal edges with high impedance and low threshold.**

1.4 Stand-by

As a standard, the units do not disconnect physically from the primary when you switch them off by means of the control signals. When controlled to OFF, the units switch OFF their output voltage and go into stand-by. During stand-by, the bus interface (see chapter 2) is fully functional, the passive shut-down function via the control input (**ADR/SD**) outlined above (without the need for external power) works and further functions for the parallel operation of several units are available. The stand-by power requirement is below 8 W across the input voltage range.

- Please note that the P140R-0530 (5.1 V) and the P140R-0720 (7.5 V) do not provide an output voltage shut-down function. During stand-by, the output voltage of the P140R-0530 is below 50 mV (at 25°C (+77°F) and without any load on +SBS); the stand-by output voltage of the P140R-0720 is approx. 1.1 V.
- Please note that the error management (see chapter 1.5) uses and monitors the stand-by.
- During stand-by, Pin 15 (**+SBS**) of the H15 connector provides a continuous supply voltage of at least 4.3 V. This output is separated from the micro-controller's supply by a diode (max. 60 V). Therefore, the +SBS outputs of several units (even of different nominal output voltages) can be simply connected in parallel.
  Keep in mind that there is no load-sharing on this output. The maximum load – even when several units are connected in parallel - must be below the specified maximum load on +SBS of the weakest unit. See the table below for details.

Operating status	Output load (+L→-L)	Maximum load on +SBS over the entire temperature range	
Type		P140R-0530, -0720, -1212	P140R-2406, -4803
Start-up (AC on)	-	≤ 5 mA*	≤ 20 mA*
OFF (Stand-by)	-	20 mA	30 mA
ON (open loop)	< 20% of nom. current	30 mA	30 mA
ON	≥ 20% of nom. current	20 mA	20 mA

* Keep the capacitive load on +SBS to an absolute minimum as this stand-by supply voltage is taken from the secondary auxiliary supply for the micro-controller. When there are current requirements in excess to the Start-up load values stated in the table above, only connect the stand-by load if the voltage on +SBS exceeds +4.0 V.

Important Notes

- **The stand-by supply (+SBS) is <u>not protected</u> against short circuits.**
- **Overloading the stand-by supply (+SBS) may lead to a temporarily failure or malfunction of the unit (e.g. over-current ticking).**
- **During stand-by, even a short-term overload may lead to malfunction of the unit.**

1.5 Error management

All units of the P140R series provide the usual mechanisms for self-protection and failure pre-warning:
- **o**ver-**v**oltage **p**rotection for both the primary and secondary side (**OVP**)
- **u**nder-**v**oltage **p**rotection on the primary side (**UVP**)
- **o**ver-**t**emperature **p**rotection for both the primary and secondary side (**OTP**).
  After a pre-warning time of approx. 10 s (OTPA, see chapter 1.3), the over-temperature protection (OTP) switches the unit into stand-by (see chapter 1.4).

Furthermore, you can activate a conjunction between the output-voltage monitoring (power-fail sensing) and a permanent OFF (hardware error), using the bus interface (see chapter 2). When this conjunction is activated (**PF to SD**) (and the unit is in normal operation), then the output voltage is switched OFF some 300 ms after the unit detects any over-voltage or under-voltage at its output terminals. The unit then reports a hardware error and is no longer ready for operation.

This hardware error can also occur on the following conditions:
- defective temperature sensor (secondary)
- port error of the micro-controller following a power-on reset
- the actual current is significantly above the nominal current limit (output-current monitoring)

To reset a hardware error, either push the two buttons simultaneously for a minimum of 1 second or send the command sequence **SD** and **ON** via the bus interface (see chapter 2). If there is no permanent error, then the unit switches its output ON again.

During stand-by and at temperatures above +5°C (+41°F), the micro-controller monitors the internal output voltage IOV (before redundancy diode and ON/OFF switch). At units with a nominal output voltage of 5.1 V and 7.5 V, this IOV has a direct influence on the output voltage during stand-by (see chapter 1.4). Any output load during stand-by increases the IOV. If the IOV exceeds a certain limit, then the unit indicates an error (not READY) and is no longer ready for operation.

2. BUS INTERFACE

2.1 Standard specifications

As a standard, the bus interface is a LIN (**L**ocal **I**nterconnect **N**etwork) interface that only needs one pin of the H15 connector (**Pin 22 – Bus**). A further Pin (**Pin 20 – ADR/SD**) allows for addressing a maximum of eight units over one LIN bus universe. The LIN bus functionality is identical for all members of the P140R series, so it does not matter, which variants you connect over the LIN bus.
- On a unit, the address and bus function (master/slave) is set by a resistor between Pin 20 (**ADR/SD**) and the output ground (**-L**) (see table overleaf for details).
- An analog voltage on Pin 20 (**ADR/SD**) determines not only whether the unit is a LIN bus master or a LIN bus slave, but also the LIN bus address.

LIN bus addresses must be unambiguous by definition. Several masters or slaves with an identical address are not permitted within a single LIN bus universe.

Recommended resistors for LIN bus addressing (between Pin 20 (**ADR/SD**) and the output ground (**-L**):

LIN bus address	Resistor value (1% tolerance)
0 (Master)	open (≥100 kΩ)
Slave 1	51 kΩ
Slave 2	27 kΩ
Slave 3	15 kΩ
Slave 4	10 kΩ
Slave 5	6.2 kΩ
Slave 6	3.9 kΩ
Slave 7	2.2 kΩ
Shut-down (OFF)	jumpered (≤1.2 kΩ)

Via the LIN bus interface, you can read out all relevant information in digital form (like status, voltage, current or temperature). The firmware of every unit provides a LIN bus master module. The LIN bus master is able to control a maximum of seven slaves. Any unit can be fully configured via the LIN bus interface. For further details, see chapter 3.3 (Example of a power supply system).

2.2 Applications

Configuration

In order to use this application, the unit must be a LIN bus slave.

You can switch the output voltage ON or OFF via the bus interface. Furthermore, you may also set both the output voltage and the limit for the output current.
We do not recommend increasing the limit for the output current as this means operating the unit beyond its specifications. The output current monitoring circuit may trigger a hardware error (see chapter 1.5).

Monitoring

In order to use this application, the unit must be a LIN bus slave.

You can read out the following data / values:
- Unit ID (type, series, variant)
- Status (ON, OFF, Error message)
- Output voltage (12 bit resolution; accuracy is ±3% of the nominal output voltage), see chapter 2.3
- Output current (12 bit resolution; accuracy is ±16% of the nominal output current), see chapter 2.3
- Temperature (in °C; accuracy is ±3K)
- Settings (setting flags)

It is possible to “listen in” on the LIN bus. However, please note:
With the current firmware release, the slaves only transmit data if the master polls them. Currently, it is not possible to poll data from a master.

Thermal load sharing

- see chapter 3.3

2.3 Protocol definitions

The driver hardware and the protocol frames are consistent with the LIN bus protocol (see Reference [3]). The bus uses an internal supply voltage of 8 to 14 V. For further details, see the data format and command structure in the LIN bus application protocol P140R, Appendix 1.

In order to calculate the actual voltage and/or current from the digital values returned from the units over the LIN bus, you need a conversion factor. The conversion factor is different for the single variants of the P140R series:

Type	Nominal output voltage	Nominal output current	VCF (voltage conversion factor)	CCF (current conversion factor)
–0530	5.1 V	30.0 A	1.563721 mV	14.97823 mA
–0720	7.5 V	20.0 A	2.441406 mV	14.97823 mA
–1212	12 V / 15 V	12.5 A / 10.0 A	5.564842 mV	7.489115 mA
–2406	24 V	6.3 A	9.735216 mV	4.780286 mA
–4803	48 V	3.2 A	16.017105 mV	2.246735 mA

Example: A P140R-2406 returns 1105 as the digital value for the actual current. Multiplied with the corresponding current conversion factor (CCF) of 4.780286 mA, this means an actual current of 5.28 A.

3. Parallel operation

3.1 Redundancy

When “n+1” power supplies are connected in parallel to supply a nominal load that “n” power supplies could handle, one power supply may fail without any negative effects on the load connected (this is what is called a „n+1” redundancy). In many cases, redundancy diodes are provided internally to avoid any influence of the defective (or switched OFF) power supply on the DC bus voltage (output voltage).

In order to keep losses to an absolute minimum, MGV actually uses a power transistor rather than a redundancy diode. The only exception to this rule is the 48 V type (-4803). If the voltage or current direction were reversed, the power transistor would quickly separate the unit (reaction time < 10 µs) from the DC bus, reliably preventing any inward current flow. Furthermore, the power transistor can also be switched OFF by the secondary micro-controller (e.g. when the unit goes into stand-by).

When the actual load current exceeds 10% of the nominal current (tolerance is -8% / +16%), the redundancy transistor is switched ON. It will be switched OFF again with a slight delay, when there is no load. Thus, the output voltage of power supplies using a redundancy transistor is some 100 mV lower during no-load operation and rises by these 100 mV under load (≥ 26% of the nominal current). This small effect helps to significantly improve the efficiency of the units and should not disturb any application.

3.2 Hot-Swap

“Hot-swap” means that any unit of an „n+1“ redundancy system may be replaced during operation. As long as you keep to the remarks in the data sheet [1] and in the safety notes [2], all units of the P140R series (with an H15 connector) are ready for hot-swap.
Allow the unit a **minimum cooling time of one minute** before you plug it in again.

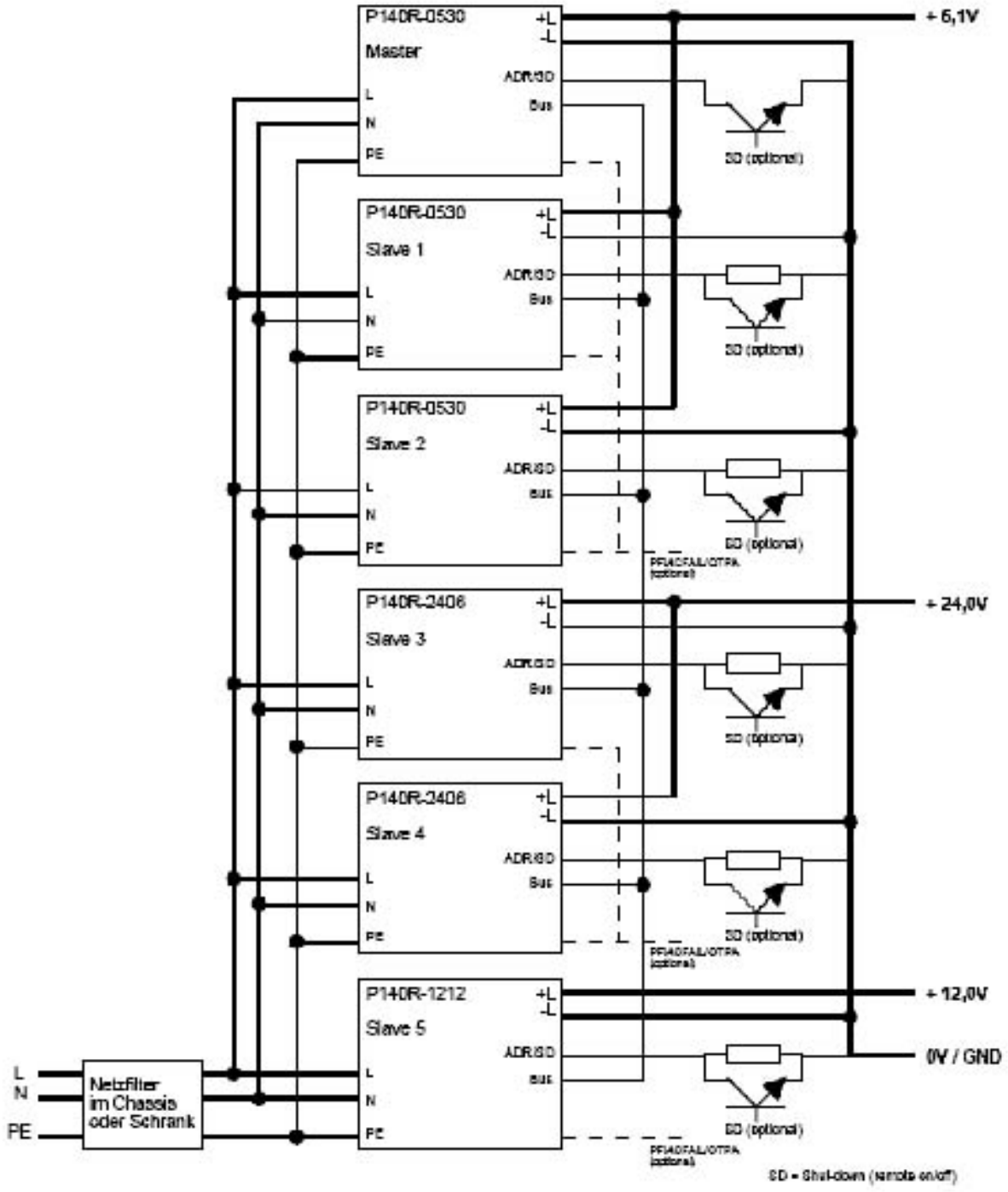
3.3 Thermal load sharing

Conventional load sharing is a good way of sharing the total current symmetrically between several parallel power supplies. However, it is its main disadvantage that it does not take the thermal status of the power supplies into consideration. A unit well positioned in the forced-cooling air stream can handle power requirements much better than a power supply that is only poorly cooled and which may reach a critical temperature even before it delivers its nominal current.

Thermal load sharing does completely away with this disadvantage: All power supplies are connected over the LIN bus. Those units delivering the identical nominal output voltage are combined to a group. Within this group, the current is shared in such a way that all power supplies are used within their specifications and reach a similar operating temperature. Thermal load sharing reliably prevents the thermal overload of single power supplies that are switched together with others in parallel.

Example of a power supply system, based on P140R units

(two groups with thermal load sharing plus a single unit)



Netzfilter = Line filter (part of the rack)

The bus master polls every power supply on the LIN bus approx. five times per second. During this poll, the unit returns its data and status (see chapter 2.2, section Monitoring).
Based on the data returned, the bus master groups the slaves according to their nominal output voltage. The maximum a master can handle are three groups with a maximum of four units each (including the master).
As this grouping starts with the lowest address (slave 1), single power supplies should have higher addresses than power supplies that are used in parallel (see Example of a power supply system on the page before).

Individually for every group, the bus master tells the unit which reported the highest temperature that it is the hottest. Furthermore, the bus master tells the unit which reported the lowest temperature that it is the coldest. If a power supply gets the identical information for a longer period of time, it adjusts its output voltage accordingly. The hottest unit reduces its output voltage slightly, while the coldest unit increases it slightly.
This strategy of changing the output voltage in opposite directions makes sure that the output voltage of the group stays the same over time and does not drift into any direction.

Following a hot-swap, the LIN bus master re-establishes the thermal load sharing group. As a first step, all previous settings are discarded. The power supplies of a group will be re-set to their individual output voltage settings and the thermal load sharing starts again.

This automated reset and the relatively long time constants of this control strategy prevent any oscillating effects even under extremely bad conditions. At the same time, the thermal load sharing makes sure that a power supply with poor cooling is not overstrained permanently.

GLOSSARY

ACFAIL	- **AC-fail** (failure of the primary AC input voltage)
ADC	- **A**nalog to **d**igital **c**onverter
ADR	- Address (Address on the LIN bus)
CCF	- **C**urrent **c**onversion **f**actor Multiply the digital current value polled (12 bit ADC) with this factor in order to calculate the actual current value.
LED	- **L**ight **e**mitting **d**iode
LIN	- short for **L**ocal **I**nterconnect **N**etwork – a short-range bus, originally developed for the automotive industry
LSB	- **L**east **s**ignificant **b**it
MSB	- **M**ost **s**ignificant **b**it
OTP	- **O**ver **t**emperature **p**rotection
OTPA	- **O**ver **t**emperature **p**rotection **a**larm
OVP	- **O**ver **v**oltage **p**rotection (input and output voltage)
PF	- **P**ower **f**ail (failure of the secondary DC output voltage)
SBS	- **S**tand-**b**y **s**upply voltage (PIN identifier on label: SBS)
SBZ	- Stand-by state
SD	- **S**hut-**d**own (the unit is switched OFF or into stand-by)
UVP	- **U**nder **v**oltage **p**rotection (input voltage)
VCF	- **V**oltage **c**onversion **f**actor Multiply the digital voltage value polled (12 bit ADC) with this factor in order to calculate the actual output voltage.

References

[1] MGV Stromversorgungen GmbH
Data sheet of the P140R series
Available online on the web under the following link:
URL: http://www.mgv.de/produkt_pdfs/en/P140R_e.pdf

[2] MGV Stromversorgungen GmbH
Safety information
Available online on the web under the following link:
URL: http://www.mgv.de/pdf/en/sicherheitshinweise.pdf

[3] © LIN Consortium
LIN Protocol Specification
Revision 1.3
Available online on the web under the following link:
URL: http://www.lin-subbus.org

APPENDIX 1

LIN bus application protocol P140R

The physical layer of the LIN bus implemented is consistent with the LIN 1.3 specifications (see [3]).

Communication Master to Slave

Data Frame

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command byte 1	Command byte 2	Parameter byte (optional)	0	0	0	0	0

Commands implemented in both the master and the slave firmware

Command (two bytes ASCII)	Parameters	Description
ON	-	Switch ON (normal operation)
O-	-	Unit (slave) has the lowest temperature (used for thermal load sharing)
O+	-	Unit (slave) has the highest temperature (used for thermal load sharing)
CE	-	Clear error flags / reset thermal load sharing

Commands implemented in the slave firmware only

Command (two bytes ASCII)	Parameters	Description
SD	-	Switch OFF (shut down)
U+	-	Increase output voltage
U-	-	Decrease output voltage
I+	-	Increase output current limit
I-	-	Decrease output current limit
SU	one byte	Set output voltage adjust byte
SI	one byte	Set output current limit adjust byte
SM	one byte	Set / Write setting flags

Note:
Five seconds after the arrival of the last command, the modified values for the output voltage and the current limit are stored in the internal flash memory.

Communication Slave to Master (standard response)

Data Frame

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Device identifier	Status flags	Ua ADC value (high byte)	Ua ADC value (low byte)	Ia ADC value (high byte)	Ia ADC value (low byte)	Temperature value (in °C)	Setting flags (stored in flash)

Device Identifier (programmed into firmware, can not be altered)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Type	Series	Version

Type = 0 → AC/DC
Type = 1 → DC/DC

Series = 0 → P140R (150 W)

Version = 0 → -0530
Version = 1 → -1212
Version = 2 → -2406
Version = 3 → -4803
Version = 4 → -0720

Example

0	0	0	0	0	0	1	0

AC/DC Power Supply, Series 0 → P140R (150 W), Version 2 → -2406

Status flags

Bit	Flag name	Description
0	Bus error	An error occurred while data was received (slave)
1	ACF / DCF	Failure of the AC or DC **input** voltage (too low or too high)
2	SD	Shut-down (output voltage is OFF)
3	Ready	Power supply is ready for operation
4	PF	Power fail (**output** voltage is out of the specified range)
5	Hardware error	Permanent hardware error of the power supply (fatal error)
6	Data error	An error of the flash memory occurred / data is reset to default values
7	WDT Reset	A reset of the watch-dog timer occurred

Ua_ADC_Value (data value representing the actual output voltage)

12 Bit Resolution → **Ua = Ua_ADC_Value * VCF**

VCF = voltage conversion factor, dependent on the variant (see chapter 2.3 for details).
Read the leading four MSBs of the high byte as 0 (12 bit ADC; these four bits are not used).

Ia_ADC_Value (data value representing the actual output current)

12 bit resolution → **Ia = Ia_ADC_Value * CCF**

CCF = current conversion factor, dependent on the variant (see chapter 2.3 for details).
Read the leading four MSBs of the high byte as 0 (12 bit ADC; these four bits are not used).

Temperature value

1 bit → 1°C
Two's Complement → Range from –40°C to +127°C

Note: Temperature Celsius [Fahrenheit] = ((TCelsius*9)/5)+32
Example: +25°C = (25*9/5)+32 = 77°F

Setting flags

This byte is stored in the flash memory. It can be written over the bus (command **SM**).
Default value is 0 for all bits.

Bit	Flag name	Description
0	PF to SD	1 = Shut-down on power failure (output voltage goes OFF)
1	-	Not used
2	PF to Sig	1 = Ignore power failure for the status signal (see chapter 1.3)
3	ACF to Sig	1 = Ignore input voltage error for the status signal (see chapter 1.3)
4	OT to Sig	1 = Ignore secondary over-temperature for the status signal (see chapter 1.3)
5	-	Not used
6	-	Not used
7	ONDelay	1 = If the unit is configured as a LIN slave, the output power is switched ON with a delay of 1 second.

LIN bus slave identifiers used (bus addresses) including parity

	Slave 1	Slave 2	Slave 3	Slave 4	Slave 5	Slave 6	Slave 7
Read	F0h	32h	B4h	76h	78h	BAh	3Ch
Write	B1h	73h	F5h	37h	39h	FBh	7Dh

(address range from 30h to 3Dh without parity)

An LDF (LIN description file) is available on request.