LCM600 Series

600 Watts
Bulk Front End

Total Power: 600 Watts
Input Voltage: 85-264 Vac
# of Outputs: Main + Standby

Special Features

- 600 W output power
- Low Cost
- 2.4"X4.5"X7.5"
- 7.41W/cu-in
- Optional 5V @ 2A housekeeping
- Industrial/Medical safety
- -40 ^{O}C to +70 ^{O}C with derating
- High efficiency 89% typical
- Variable speed "smart fans"
- DSP controlled front end
- Conformal coat option
- ±20% adjustment range
- Margin programming
- OR-ing FET
- Terminal block input option

Safety

UL/CSA:	UL/CSA62368-1
TUV:	EN62368-1
CB Report:	IEC60950-1 IEC60601-1
CCC:	GB4943,GB9254 and GB17625
UL/CSA:	ES60601-1 CSA C22.2 No.60601-1
TUV:	EN60601-1

Product Descriptions

The LCM600 series are industry's low cost 600 W ac-dc power supplies, they maintain Emerson Network Power's high standards of quality and reliability, demonstrated by a MTBF of greater than 500,000 hours under normal operating condition. A wide array of safety approvals make the LCM600 series ideal for use in a variety of applications in industrial, medical, process and digital signage/display markets.

The LCM600 series output power density is 7.41W per cubic inch. Like other power supplies. The power supply comes equipped with variable speed "smart" fans supported by integrated controls to enhance reliability and achieve even higher levels of energy efficiency.

The LCM600 series are equipped with active Power Factor Correction (PFC) rated at 0.99 typical to minimize input harmonic current distortion. It features active ac inrush controls-limiting inrush current at power-on to 25 A and is protected against overvoltage conditions up to 145 percent. The power supply can be equipped with an optional 5 V auxiliary output for powering standby circuitry when minimizing unplanned downtime and enhancing serviceability are critical. An ORing FET is also available.

The LCM600 series support a wide operating temperature range of minus 40 to plus 70 degrees Celsius, providing design flexibility for applications in a variety of demanding environments.

ARTESYN™
An Advanced Energy Company

Model Numbers

Standard[1]	Output Voltage	Minimum Load	Maximum Load[2]	Adjustment range	Maximum Power [3]
LCM600L	12Vdc	0A	52A	9.6-14.4Vdc	600W
LCM600N	15Vdc	0A	44A	12.0-19.5Vdc	600W
LCM600Q	24Vdc	0A	27A	19.2-28.8Vdc	600W
LCM600U	36Vdc	0A	18A	28.8-43.2Vdc	600W
LCM600W	48Vdc	0A	13A	38.4-57.6Vdc	600W

Note 1 - Add “-T” for terminal block instead of IEC input.
Add “-4” for 5V standby.
Add “-A” for new aesthetics.
Add “-N” for low noise model on 12 V or 24 V models.

Note 2 - Maximum load current can be extended but output voltage needs to be adjusted to minimum value to meet 600W output power. If output voltage is further trimmed down to -20% of the nominal, the same max output load applies. On the other hand, increasing the output voltage to +20% of the nominal should decrease output load accordingly to meet 600W output power.

Note 3 - The maximum continuous average output power from this power supply will be 600W or 610W if the optional standby is available.

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage:						
AC continuous operation	All models	$V_{IN,AC}$	85	-	264	Vac
Maximum Output Power, continuous	All models	$P_{O,max}$	-	-	600	W
Isolation Voltage(Qualification)						
Input to outputs(2xMOPP)	All models		-	-	4000	Vac
Input to safety ground(1XMOPP)	All models		-	-	2500	Vdc
Outputs to safety ground(1XMOPP)	All models		-	-	500	Vdc
Isolation Voltage(Production)						
Input to outputs(2xMOPP)	All models		-	-	1800	Vac
Input to safety ground(1XMOPP)	All models		-	-	1800	Vdc
Outputs to safety ground(1XMOPP)	All models		-	-	200	Vdc
Ambient Operating Temperature	All models	T_A	-40	-	+70[1]	^{O}C
Storage Temperature	All models	T_{STG}	-40	-	+85	^{O}C
Humidity (non-condensing)						
Operating	All models		20	-	90	%
Non-operating	All models		10	-	95	%
Altitude						
Operating	All models		-	-	16,404.2	feet
Non-operating	All models		-	-	30,000	feet

Note 1 - Line derating each output at 2.5% per degree C from 50 ^{O}C to 70 ^{O}C (see page 30 power derating curve)

Electrical Specifications

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, AC	All	$V_{IN,AC}$	85	115/230	264	Vac
Input AC Frequency	All	f_{IN}	47	50/60	440	Hz
Maximum steady state Input Current	$V_{IN,AC}$ = 100Vac	$I_{IN,max}$	-	-	8	A
Standby Input Current (V_O =Off, I_{SB} = 0A)	All				250	mA
No Load Input Current (V_O =On, I_O = 0A, I_{SB} = 0A)	All	$I_{IN,no-load}$	- -	- -	350	mA
Harmonic Line Currents	All	THD	Per EN61000-3-2			
Power Factor	$I_O = I_{O,max}$ $V_{IN,AC}$ = 85 to 264Vac	PF	-	0.99	-	-
Startup Surge Current (Inrush) @ 25^{O}C	$V_{IN,AC}$ = 264Vac	$I_{IN,surge}$	-	-	25	A_{PK}
Input Fuse	Internal, L and N 250Vac rated		-	-	10	A
Input AC Low Line Start-up Voltage	$I_O = I_{O,max}$	$V_{IN,AC-start}$	70	-	80	Vac
Input AC Undervoltage Lockout Voltage	$I_O = I_{O,max}$	$V_{IN,AC-stop}$	50	-	65	Vac
Standby Input Power (V_O Off, I_{SB} = 0A)	All		-	-	15	W
No Load Input Power (I_O = 0)	All	$P_{IN,no-load}$	-	-	30	W
PFC Switching Frequency	All	$f_{SW,PFC}$	60	-	70	KHz
Ripple Switching Frequency	LCM600N LCM600Q LCM600U LCM600W	$f_{SW,DC-DC}$	140	-	150	KHz
	LCM600L	$f_{SW,DC-DC}$	150	-	160	KHz
Efficiency (TA = 25^{O}C, forced air cooling and include the o-ring losses)	$V_{IN,AC}$ = 230Vac $I_O = I_{O,max}$	η	-	89	-	%

Input Specifications con't

Table 2 Con't. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Hold Up Time	$V_{IN,AC}$ = 100Vac $P_O = P_{O,max}$ T_A = 25 ^{0}C	$t_{Hold-Up}$	20	-	-	mSec
Turn On Delay Resistive Load	$V_{IN,AC}$ = 85Vac $I_O = I_{O,max}$	$t_{Turn-On}$	-	-	3	Sec
Leakage Current to safety ground	UL test method	$I_{IN,leakage}$	-	-	0.3	mA
	IEC test method	$I_{IN,leakage}$	-	-	0.5	mA

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Factory Set Voltage	LCM600L	I_O = 0A	$V_{O,factory}$	11.94	12.0	12.06	Vdc
	LCM600N			14.925	15.0	15.075	
	LCM600Q			23.88	24.0	24.12	
	LCM600U			35.82	36.0	36.18	
	LCM600W			47.76	48.0	48.24	
Output Adjust Range	LCM600L	I_O = 0A See note 1	V_O	9.6	-	14.4	Vdc
	LCM600N			12	-	19.5	
	LCM600Q			19.2	-	28.8	
	LCM600U			28.8	-	43.2	
	LCM600W			38.4	-	57.6	
Standby Output Adjust Range			V_{SB}	4.8	5	5.4	Vdc
Total Regulation		Inclusive of line, load temperature change, warm-up drift	V_O	-2.0	-	+2.0	$\%V_O$
Output Ripple, pk-pk	LCM600L	See note 2	V_O	-	-	120	mV
	LCM600N			-	-	150	
	LCM600Q			-	-	240	
	LCM600U			-	-	360	
	LCM600W			-	-	480	
Standby Output Ripple, pk-pk			V_{SB}	-	-	100	mV
Output Current, continuous	LCM600L	See note 3 and 4	$I_{O,max}$	0	-	54	A
	LCM600N					44	
	LCM600Q					27	
	LCM600U					16.7	
	LCM600W					14	
Maximum Output Power, continuous			$P_{O,max}$	-	-	600	W
Standby Output Current			I_{SB}	0	-	2	A

Output Specifications con't

Table 3. Output Specifications:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Dynamic Response - Peak Deviation	50% to 100% of $I_{O,max}$ Slew rate = 1A/µs See note 5	$\pm\%V_O$	-	-	2	%
Turn On Overshoot	I_O = 0	$\%V_O$	-	-	10	%
Overload Protection	Bouncing mode	I_O	105		125	% $I_{O,max}$
Standby Overload Protection		I_{SB}	120	-	170	$\%I_{SB,max}$
Over Voltage Protection		V_O	125	-	145	%Vo
Standby Output Voltage Protection		V_{SB}	110	-	125	$\%V_{SB}$
Load Capacitance	Startup		0	-	4700	µF
Standby Max Capacitive Load			0	-	270	µF
Over Temperature Protection	Auto Recovery	10 - 15 ^{O}C above safe operating area				

Note 1 - See page 21 for Voltage Adjustment Pot Location
Note 2 - Measure with a 0.1mF ceramic capacitor in parallel with a 10mF tantalum capacitor using a 20MHz bandwidth limited oscilloscope
Note 3 - Standard operating orientation is front side facing forward.
Note 4 - Operation up to 50% load permissible with sideways (horizontal) or front side up (top) mounting orientation
Note 5 - Tested with minimum output capacitor of 470µF on main output and 270µF on 5V standby. For LCM600L/N series, main output is tested with 4700µF output capacitor with a minimum loading of 10% with respect to its maximum load.

LCM600L Performance Curves

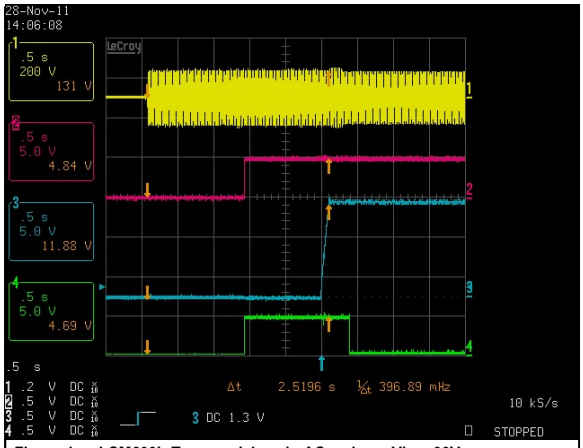


Figure 1: LCM600L Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

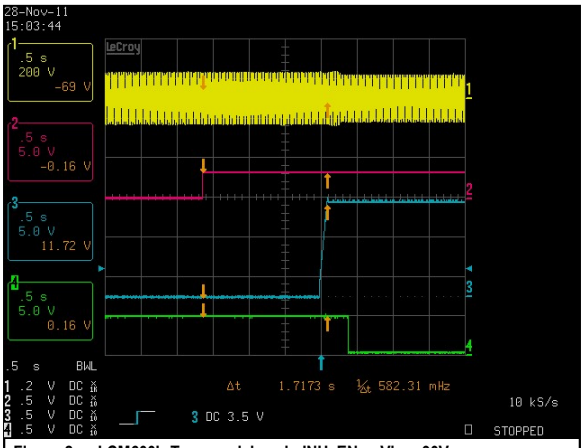


Figure 2: LCM600L Turn-on delay via INH_EN – Vin = 90Vac
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: INH_EN Ch 3: Vo Ch 4: POWER GOOD

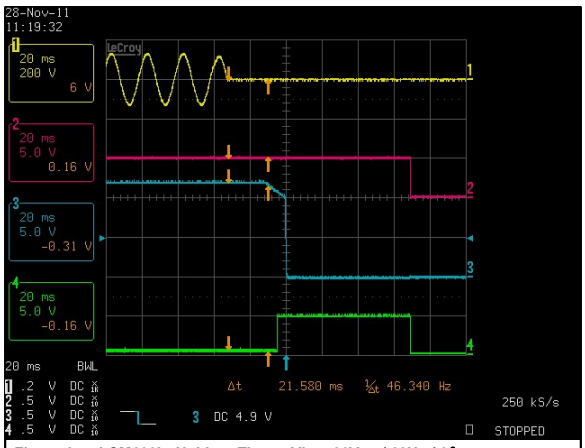


Figure 3: LCM600L Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

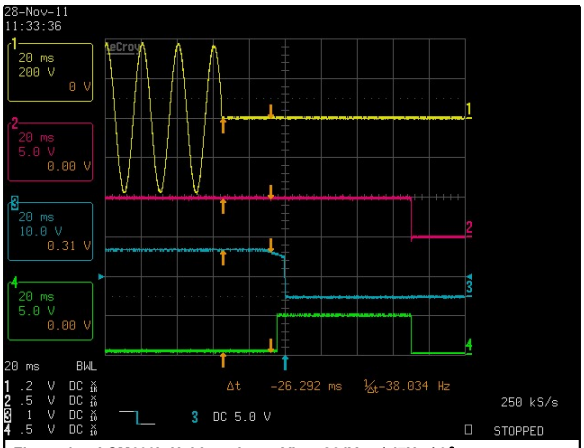


Figure 4: LCM600L Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

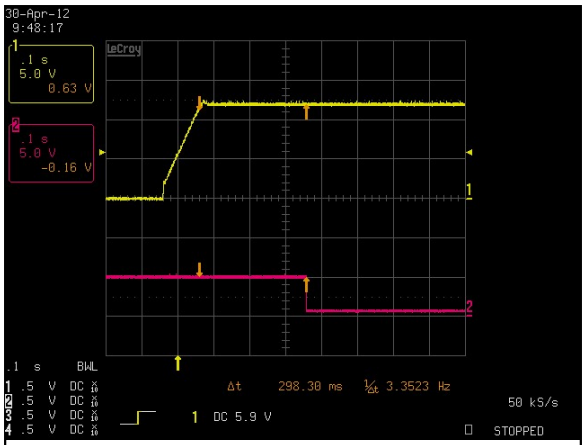


Figure 5: LCM600L Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: Vo Ch 2: POWER GOOD

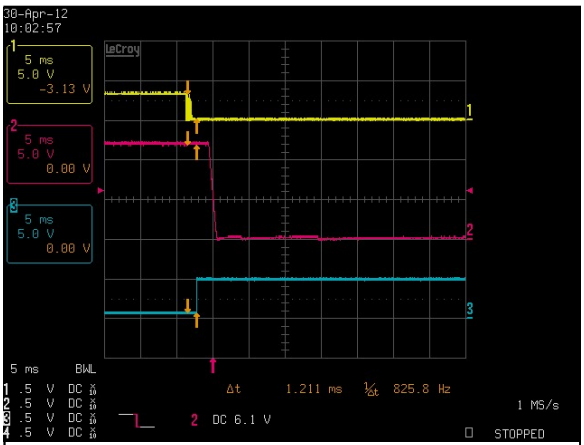


Figure 6: LCM600L Turn Off Characteristic via INH_EN
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: INH_EN Ch 2: Vo Ch 3: POWER GOOD

LCM600L Performance Curves

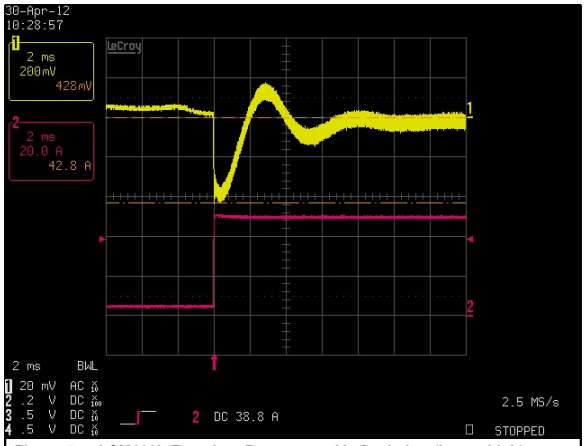


Figure 7: LCM600L Transient Response – Vo Deviation (low to high)
10% to 100% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

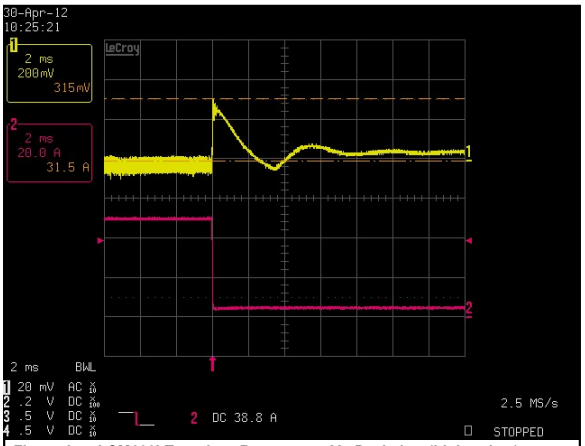


Figure 8: LCM600LTransient Response – Vo Deviation (high to low)
100% to 10% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

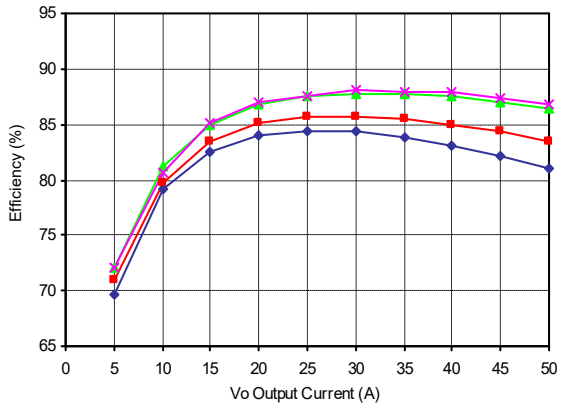


Figure 9: LCM600L Efficiency Curves @ 25 degC,
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 50A, I_{SB} = 0A (5V)

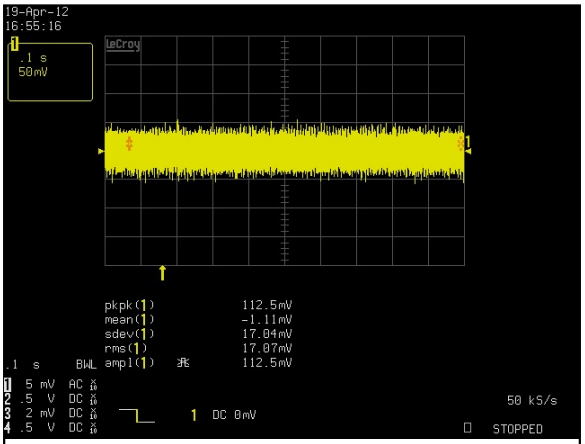


Figure 10: LCM600L Ripple and Noise Measurement – Vin = 90Vac
Full Load: Io = 50A (12V), I_{SB} = 2A (5V)
Ch 1: Vo

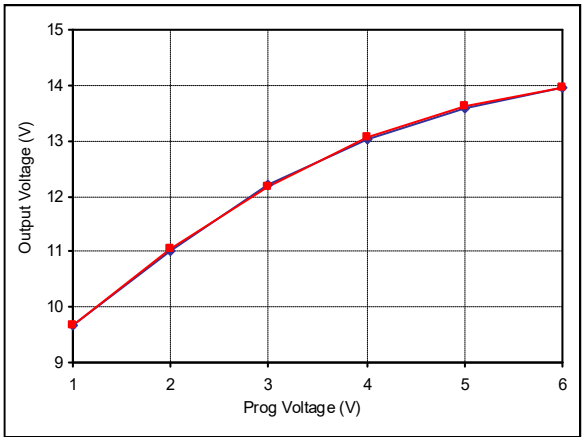


Figure 11: LCM600L Output Voltage Adjustment by Vprom @ 25 degC,
115 Vac 230 Vac
Loading: Io = 0A (12V), I_{SB} = 0A (5V)

LCM600N Performance Curves

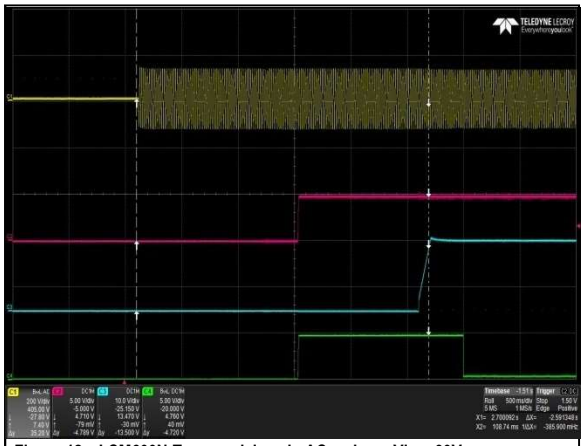


Figure 12: LCM600N Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io = 40A (15V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

Figure 13: LCM600N Turn-on delay via INH_EN – Vin = 90Vac
Full Load: Io = 40A (15V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: INH_EN Ch 3: Vo Ch 4: POWER GOOD

Figure 14: LCM600N Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 40A (15V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

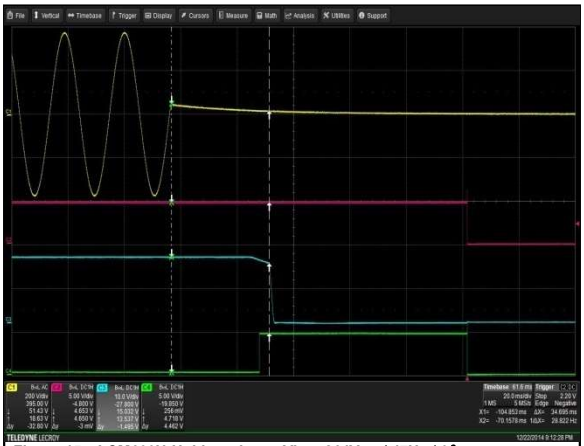


Figure 15: LCM600N Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Io = 40A (15V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

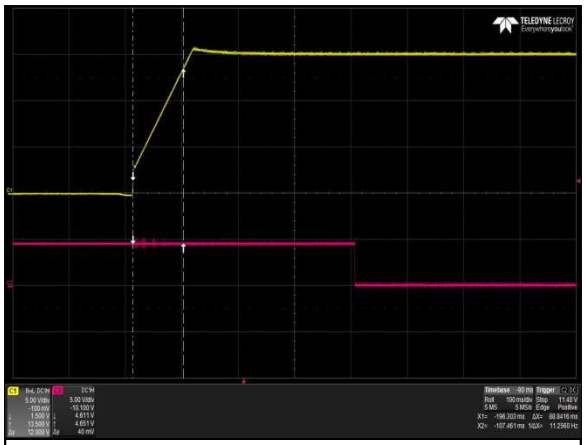


Figure 16: LCM600N Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Io = 40A (15V), I_{SB} = 2A (5V)
Ch 1: Vo Ch 2: POWER GOOD

Figure 17: LCM600N Turn Off Characteristic via INH_EN
Full Load: Io = 40A(15V), I_{SB} = 2A (5V)
Ch 1: INH_EN Ch 2: Vo Ch 3: POWER GOOD

LCM600N Performance Curves

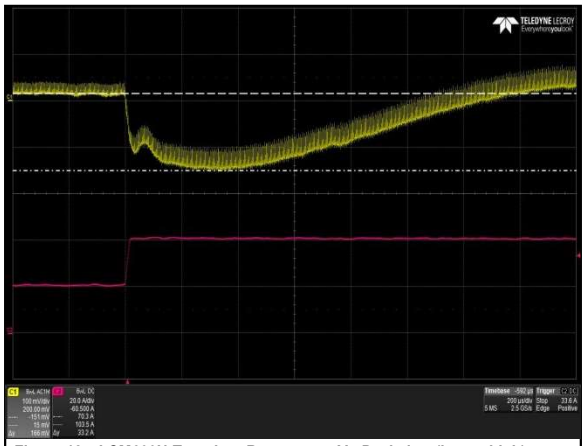


Figure 18: LCM600N Transient Response – Vo Deviation (low to high)
50% to 100% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

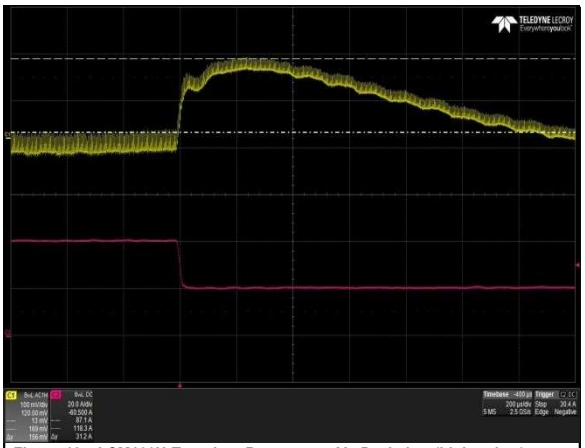


Figure 19: LCM600N Transient Response – Vo Deviation (high to low)
100% to 50% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

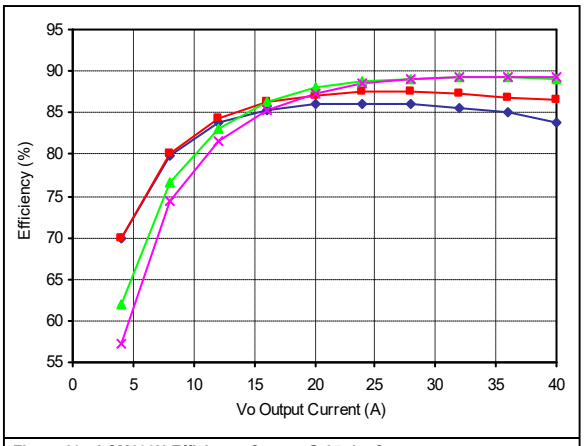


Figure 20: LCM600N Efficiency Curves @ 25 degC,
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 40A, I_{SB} = 0A (5V)

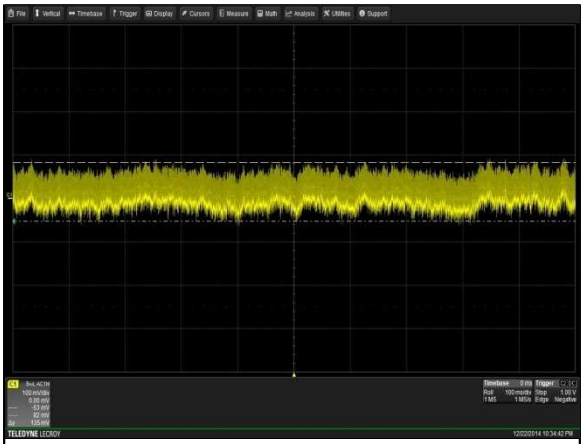


Figure 21: LCM600N Ripple and Noise Measurement – Vin = 115Vac
Full Load: Io = 40A (15V), I_{SB} = 2A (5V)
Ch 1: Vo

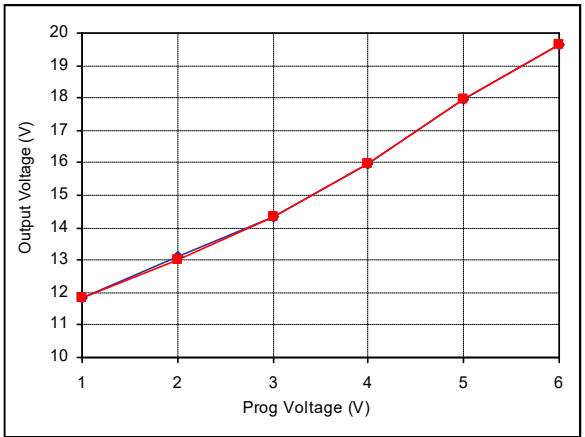


Figure 22: LCM600N Output Voltage Adjustment by Vprom @ 25 degC,
115 Vac 230 Vac
Loading: Io = 0A (15V), I_{SB} = 0A (5V),

LCM600Q Performance Curves

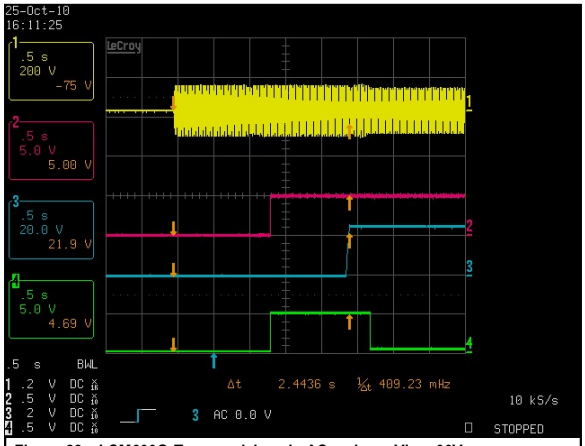


Figure 23: LCM600Q Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io = 25A (24V), I_{SB} = IA (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

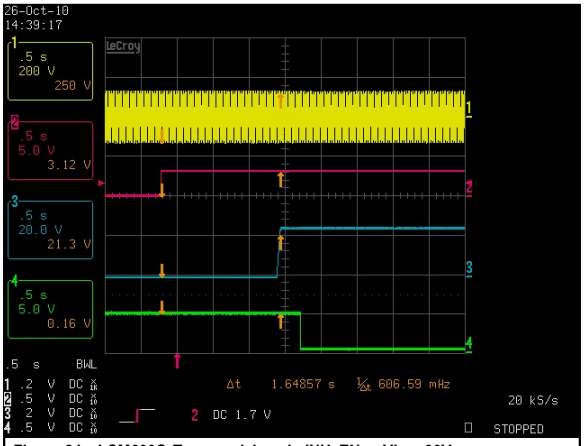


Figure 24: LCM600Q Turn-on delay via INH_EN – Vin = 90Vac
Full Load: Io = 25A (24V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: INH_EN Ch 3: Vo Ch 4: POWER GOOD

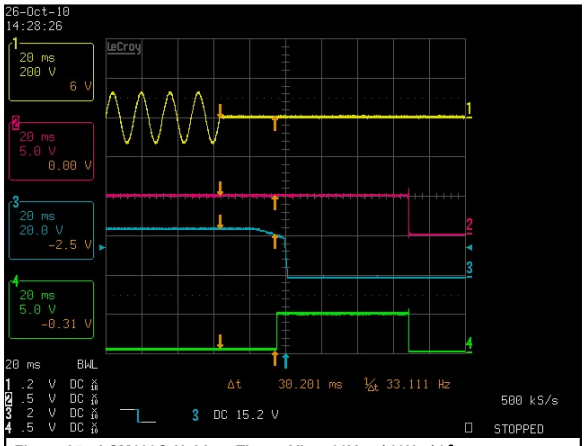


Figure 25: LCM600Q Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 25A (24V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

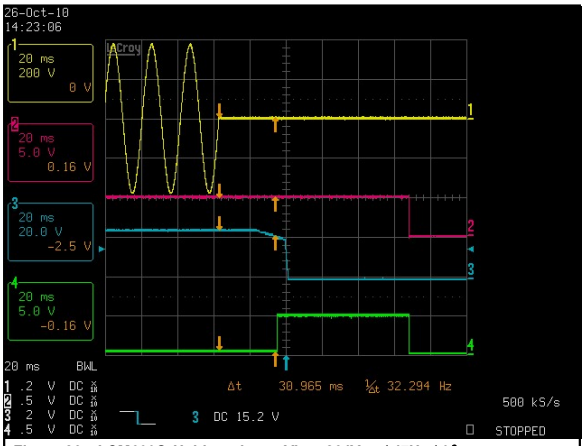


Figure 26: LCM600Q Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Vo = 25A (24V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

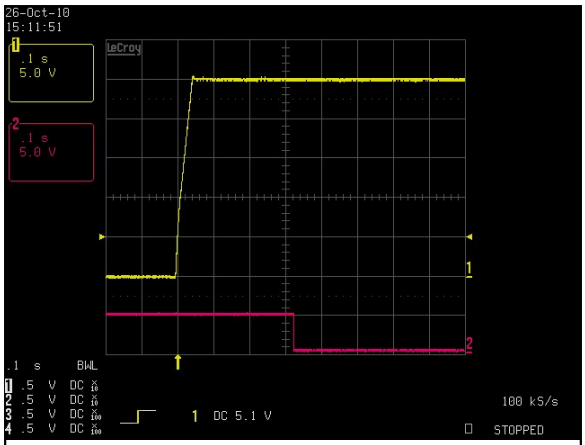


Figure 27: LCM600Q Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Io = 25A (24V), I_{SB} = 2A (5V)
Ch 1: Vo Ch 2: POWER GOOD

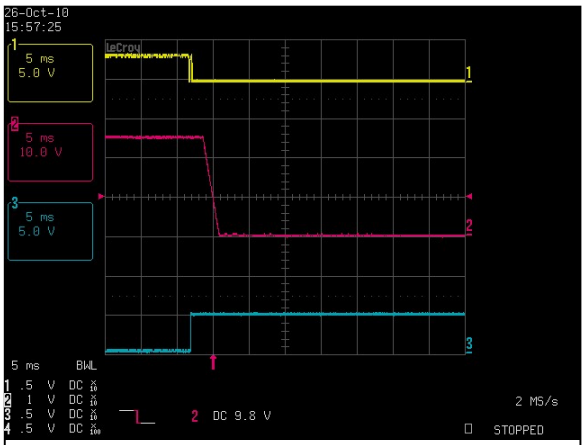


Figure 28: LCM600Q Turn Off Characteristic via INH_EN
Full Load: Io = 25A (24V), I_{SB} = 2A (5V)
Ch 1: INH_EN Ch 2: Vo Ch 3: POWER GOOD

LCM600Q Performance Curves

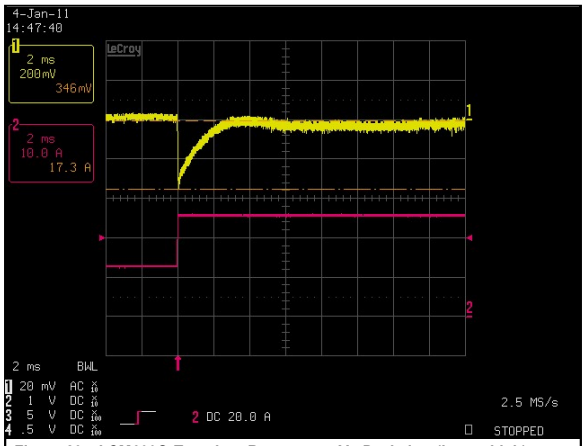


Figure 29: LCM600Q Transient Response – Vo Deviation (low to high)
50% to 100% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

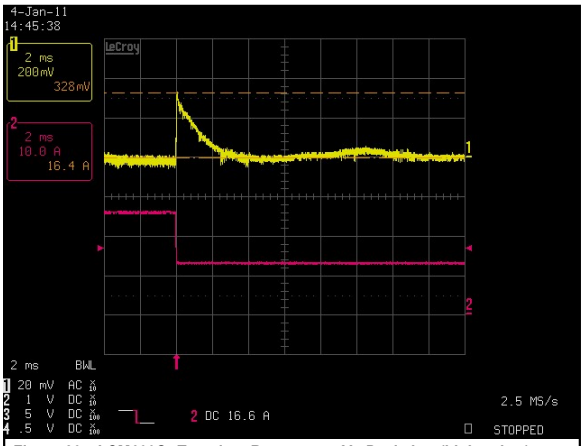


Figure 30: LCM600Q Transient Response – Vo Deviation (high to low)
100% to 50% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

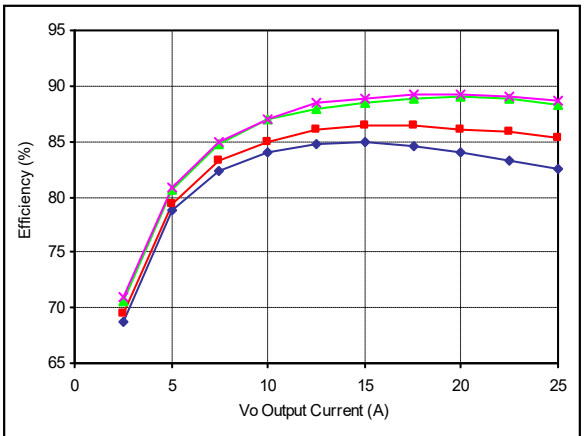


Figure 31: LCM600Q Efficiency Curves @ 25 degC,
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 25A, I_{SB} = 0A (5V)

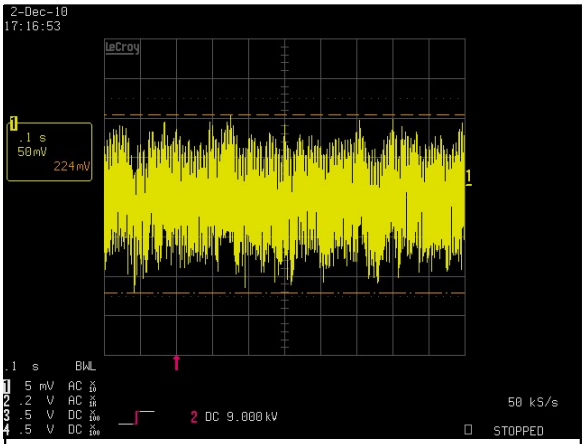


Figure 32: LCM600Q Ripple and Noise Measurement – Vin = 90Vac
Full Load: Vo = 25A (24V), I_{SB} = 2A (5V)
Ch 1: Vo

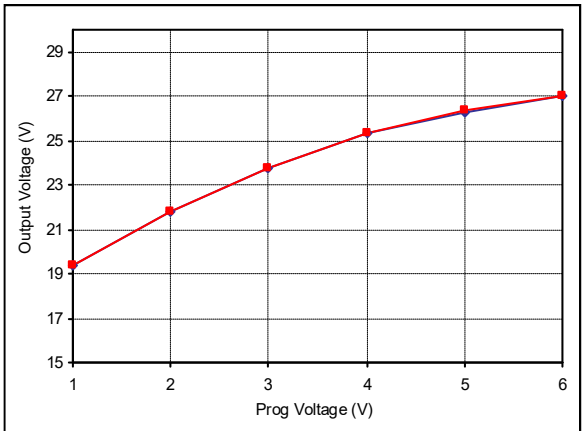


Figure 33: LCM600Q Output Voltage Adjustment by Vprom @ 25 degC,
115 Vac 230 Vac
Loading: Io = 0A (24V), I_{SB} = 0A (5V),

LCM600U Performance Curves

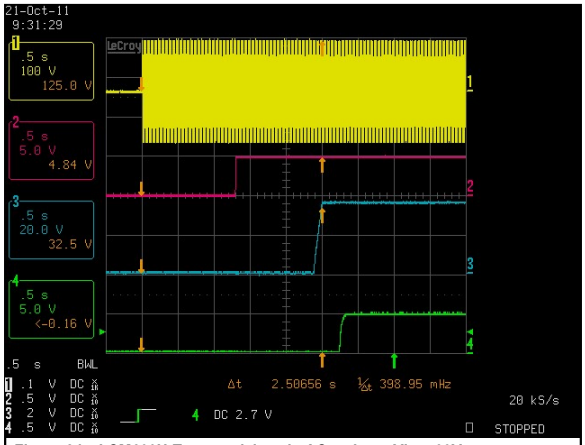


Figure 34: LCM600U Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

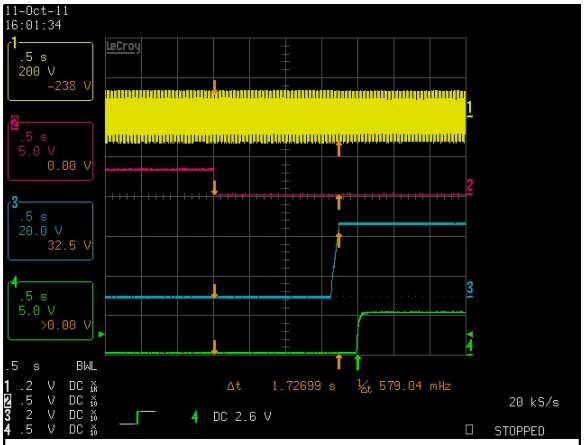


Figure 35: LCM600U Turn-on delay via INH_EN – Vin = 90Vac
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: INH_EN Ch 3: Vo Ch 4: POWER GOOD

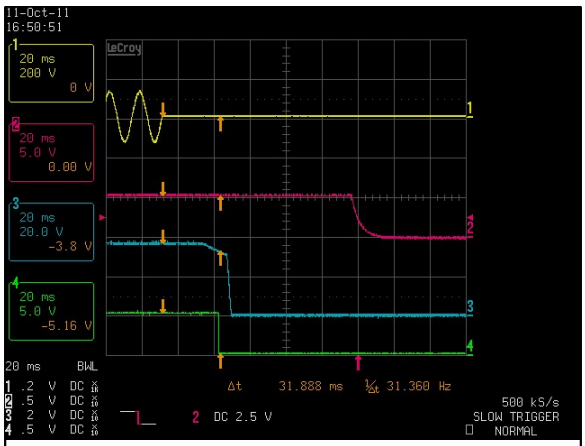


Figure 36: LCM600U Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

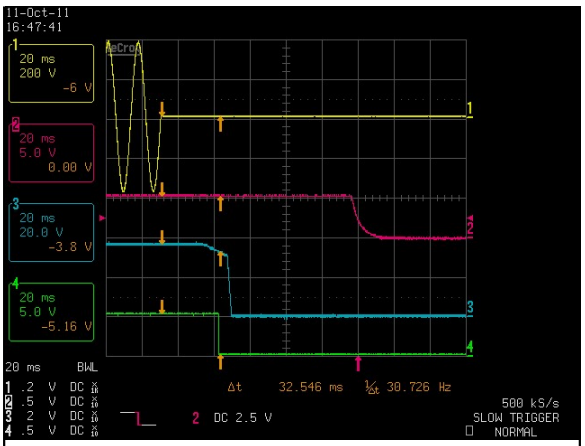


Figure 37: LCM600U Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

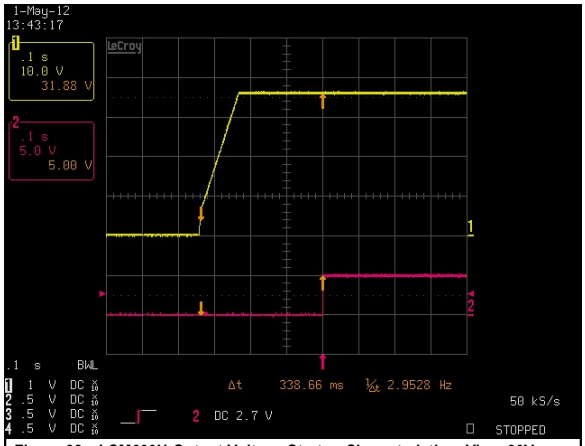


Figure 38: LCM600U Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: Vo Ch 2: POWER GOOD

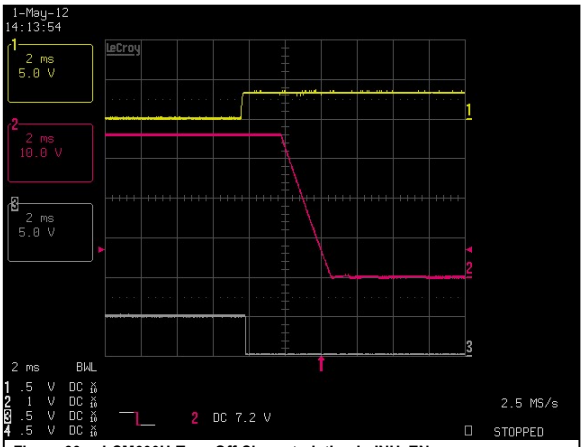


Figure 39: LCM600U Turn Off Characteristic via INH_EN
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: INH_EN Ch 2: Vo Ch 3: POWER GOOD

LCM600U Performance Curves

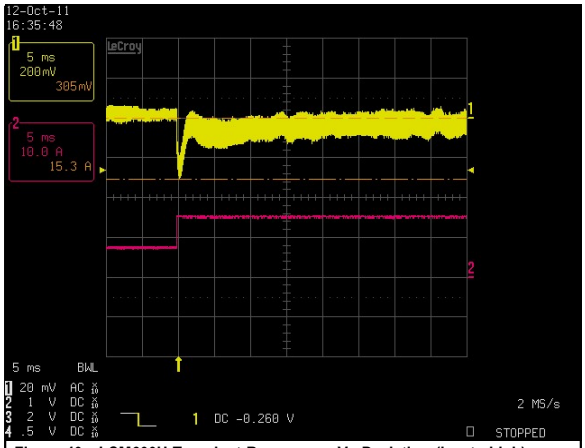


Figure 40: LCM600U Transient Response – Vo Deviation (low to high)
50% to 100% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

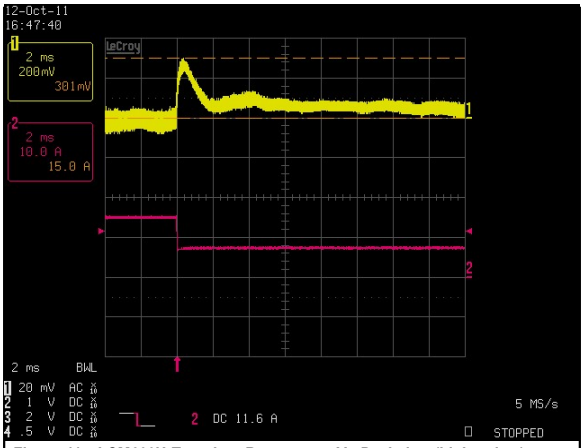


Figure 41: LCM600U Transient Response – Vo Deviation (high to low)
100% to 50% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

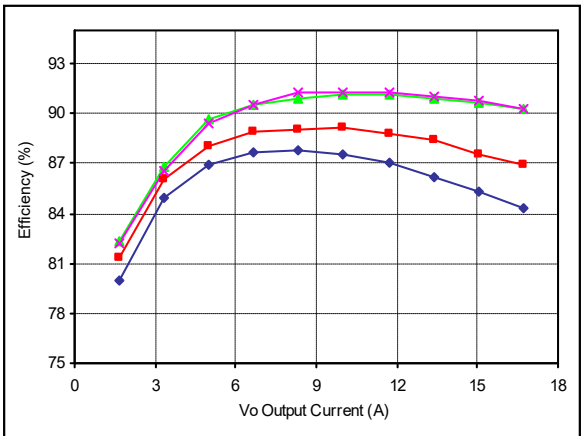


Figure 42: LCM600U Efficiency Curves @ 25 degC,
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 16.7A, I_{SB} = 0A (5V)

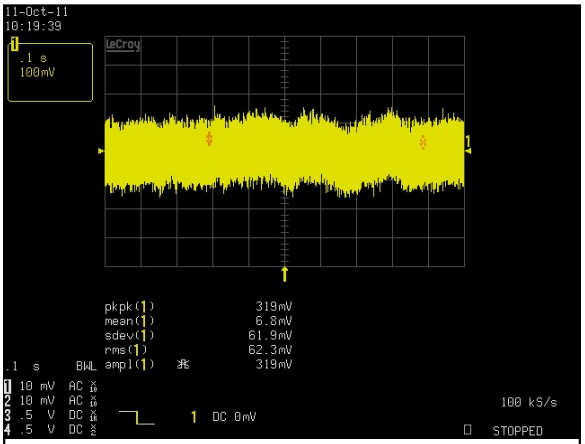


Figure 43: LCM600U Ripple and Noise Measurement – Vin = 115Vac
Full Load: Io = 16.7A (36V), I_{SB} = 2A (5V)
Ch 1: Vo

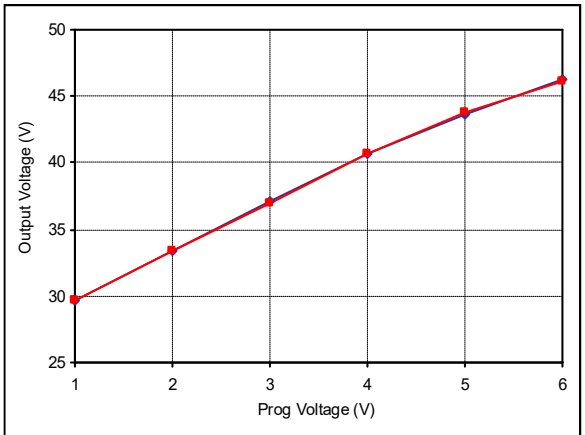


Figure 44: LCM600U Output Voltage Adjustment by Vprom @ 25 degC,
115 Vac 230 Vac
Loading: Io = 0A (36V), I_{SB} = 0A (5V),

LCM600W Performance Curves

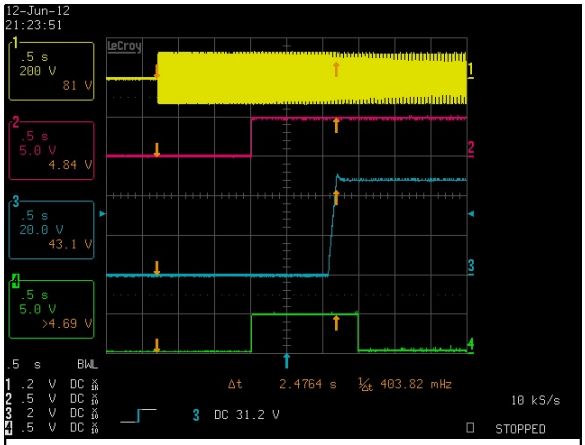


Figure 45: LCM600W Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io = 12.5A (48V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

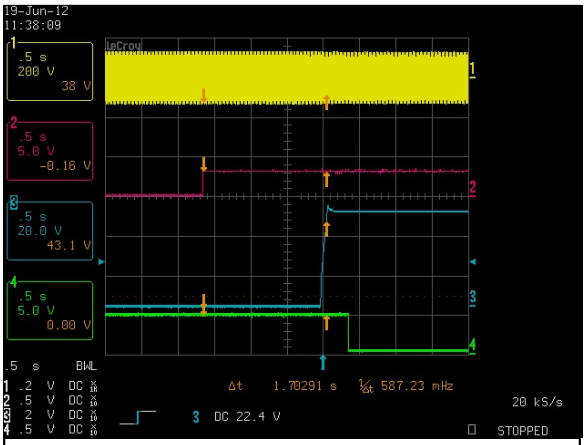


Figure 46: LCM600W Turn-on delay via INH_EN – Vin = 90Vac
Full Load: Io = 12.5A (48V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: INH_EN Ch 3: Vo Ch 4: POWER GOOD

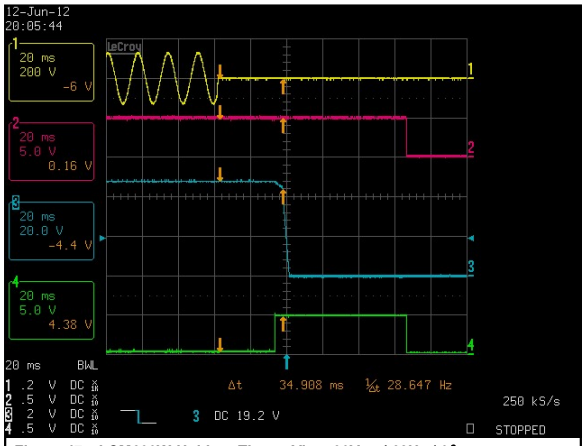


Figure 47: LCM600W Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 12.5A (48V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

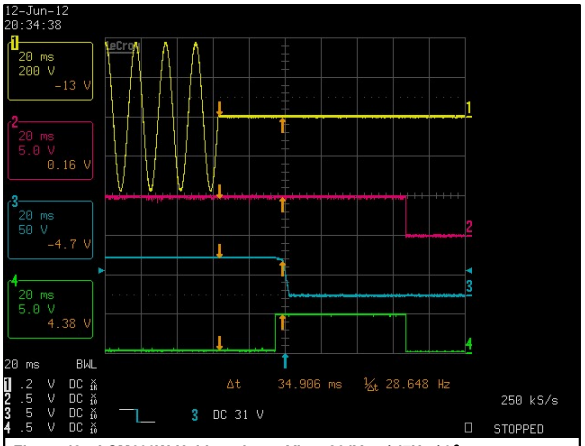


Figure 48: LCM600W Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Io = 12.5A (48V), I_{SB} = 2A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

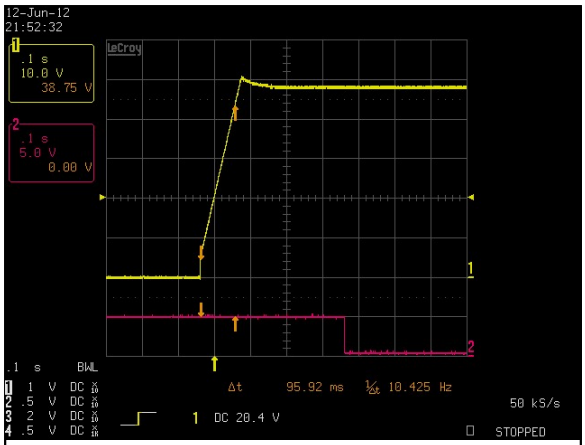


Figure 49: LCM600W Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Io = 12.5A (48V), I_{SB} = 2A (5V)
Ch 1: Vo Ch 2: POWER GOOD

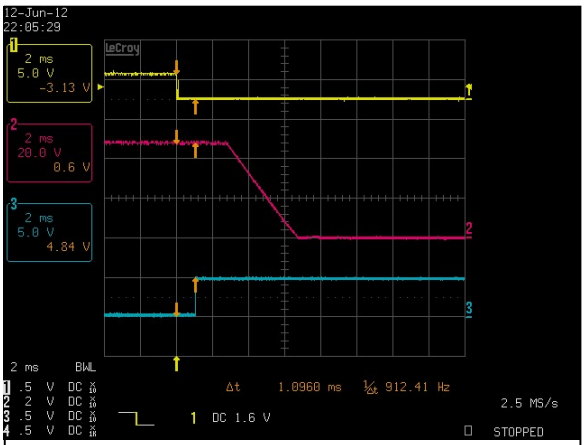


Figure 50: LCM600W Turn Off Characteristic via INH_EN
Full Load: Io = 12.5A (48V), I_{SB} = 2A (5V)
Ch 1: INH_EN Ch 2: Vo Ch 3: POWER GOOD

LCM600W Performance Curves

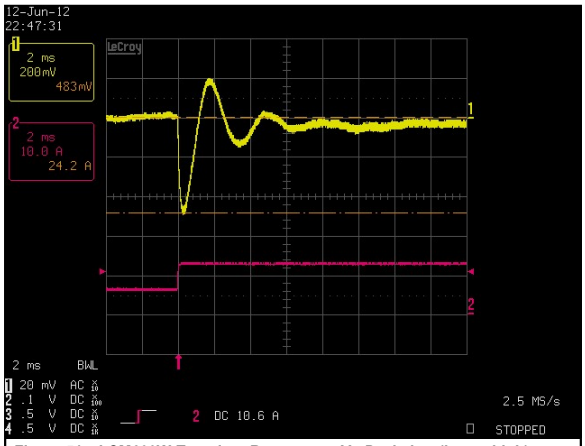


Figure 51: LCM600W Transient Response – Vo Deviation (low to high)
50% to 100% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

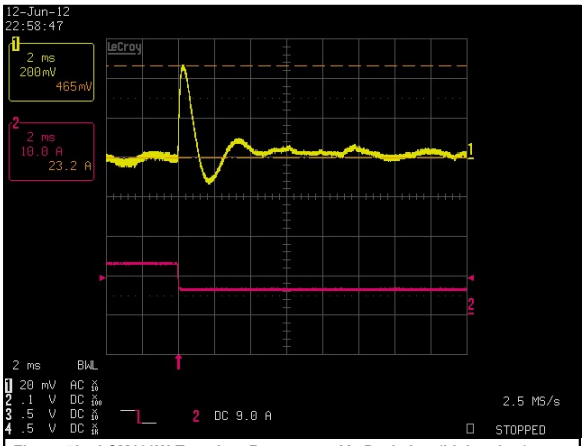


Figure 52: LCM600W Transient Response – Vo Deviation (high to low)
100% to 50% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

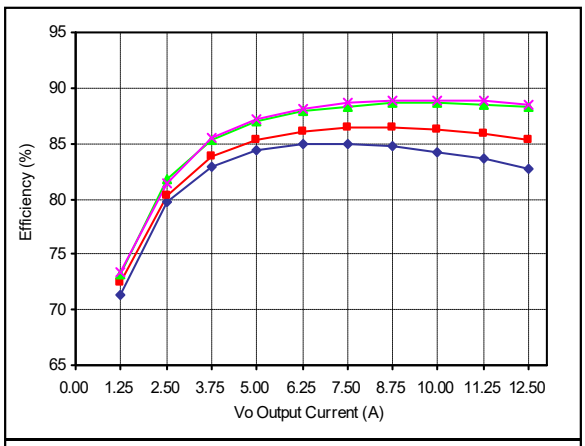


Figure 53: LCM600W Efficiency Curves @ 25 degC,
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 12.5A, I_{SB} = 0A (5V)

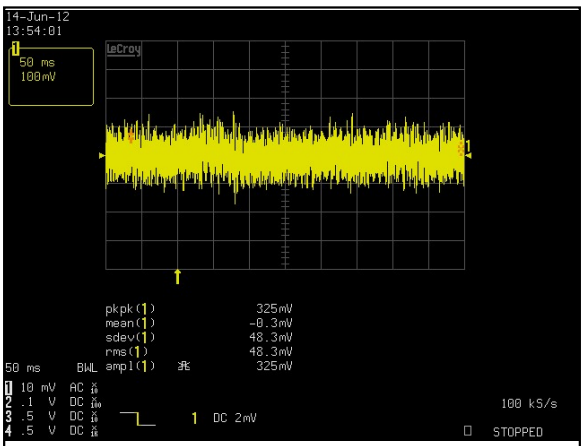


Figure 54: LCM600W Ripple and Noise Measurement – Vin = 90Vac
Full Load: Io =12.5A (48V), I_{SB} = 2A (5V)
Ch 1: Vo

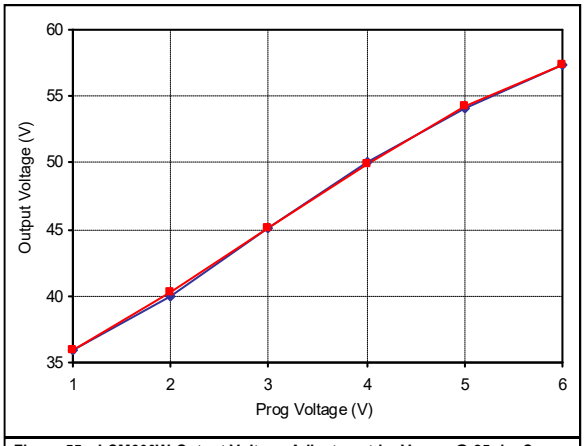


Figure 55: LCM600W Output Voltage Adjustment by Vprom @ 25 degC,
115 Vac 230 Vac
Loading: Io = 0A (48V), I_{SB} = 0A (5V),

Protection Function Specification

Input Fusing

LCM600 series are equipped with an internal non user serviceable 10A High Rupturing Capacity (HRC) 250 Vac fuse to IEC 127 for fault protection in both L1 and L2 lines input.

Over Voltage / Under Voltage Protection (OVP)

The power supply latches off during output overvoltage with the AC line recycled to reset the latch.

OVP

Parameter	Min	Nom	Max	Unit
LCM600L Overvoltage	15.0	/	17.4	V
LCM600N Overvoltage	21.2	/	21.75	V
LCM600Q Overvoltage	30.0	/	34.8	V
LCM600U Overvoltage	45.0	/	52.2	V
LCM600W Overvoltage	60.0	/	69.6	V
V_{SB} Standby Overvoltage	7.0	/	7.5	V

Over Current Protection (OCP)

LCM600 series output will be in bouncing mode with a recovery time delay of 20 sec (for LCM600Q/U/W series) or 30 sec (for LCM600L/N series) when the output current hits the OCP limit provided.

Parameter	Min	Nom	Max	Unit
V_O Output Overcurrent	105	/	125	%Io,max
V_{SB} Standby Overcurrent	120	/	170	$\%I_{SB,}$max

Short Circuit Protection (SCP)

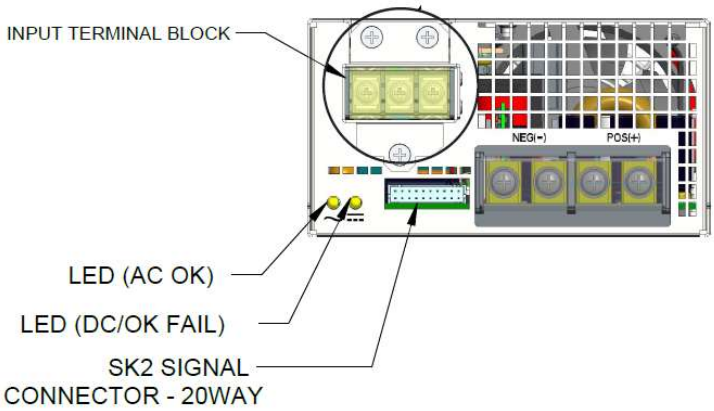
A short circuit is defined as less than 0.03 ohm resistance between the output terminals. All outputs will be protected against short circuit to ground or other outputs. No damage will result. In the event of short circuit PSU output will be in bouncing mode with a recovery delay of 20 Sec. Optional 5V standby, independent of the main output, will also be in bouncing mode once the fault occurred.

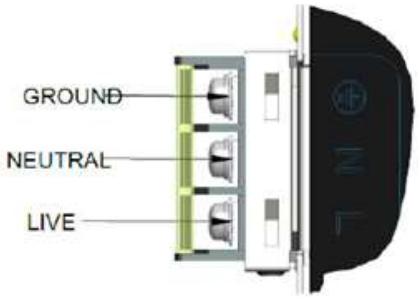
Over Temperature Protection (OTP)

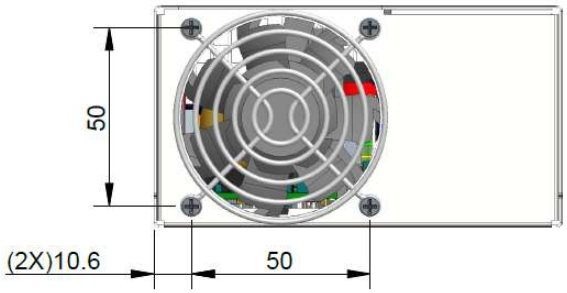
The power supply will be internally protected against over temperature conditions. When the OTP circuit is activated, the power supply will shut off and will auto-recover once the OTP condition is gone. The OTP will not be triggered when PSU is running at any given operating ambient and load.

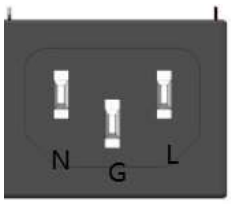
Mechanical Specifications

Mechanical Outlines





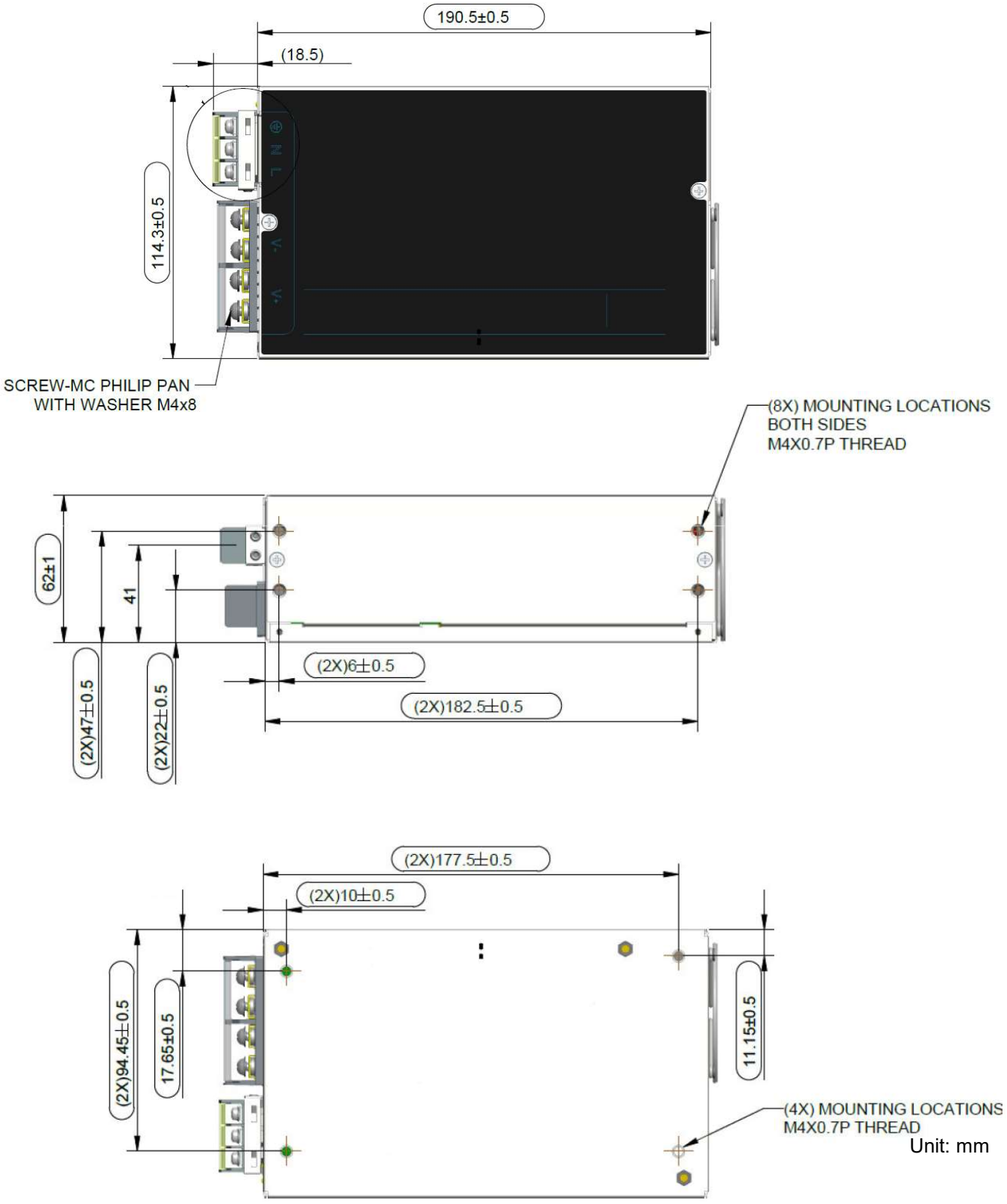




IEC
AC INLET VERSION

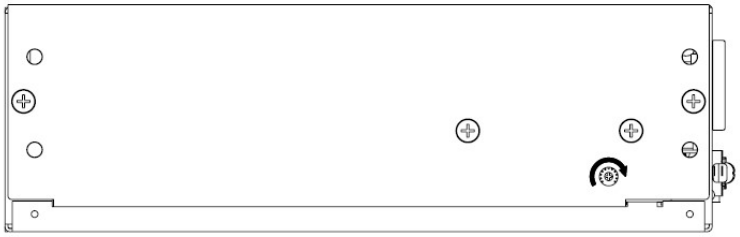
Unit: mm

Mechanical Outlines

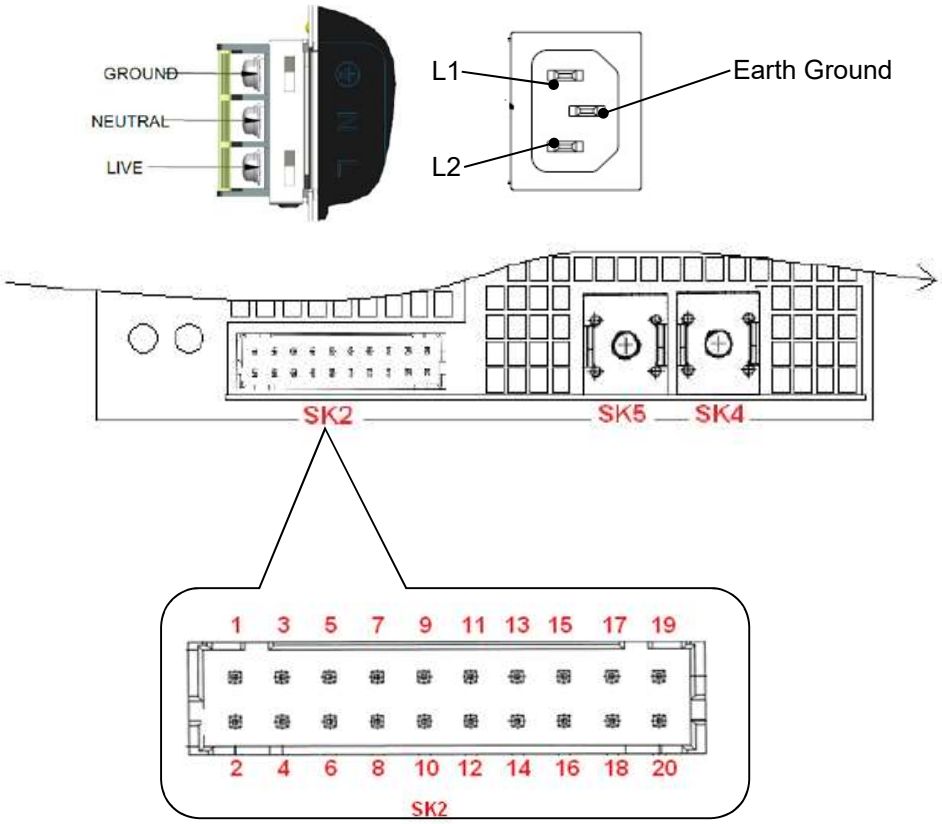


Unit: mm

Mechanical Outlines - Voltage Adjustment Pot Location



Connector Definitions



AC Input Connector – SK1

Pin 1 – Live

Pin 2 – Neutral

Pin3 – Ground

Output Connector – SK4&SK5

SK4(&SK3) – + Main Output (Vo)

SK5(&SK6) – Main Output Return

Control Signals – SK2

Pin 1 – A2

Pin 2 – -VPROG

Pin 3 – A1

Pin 4 – -Vsense

Pin 5 – ISHARE

Pin 6 – A0

Pin 7 – SDA1

Pin 8 – +VPROG

Pin 9 – SCL1

Pin 10 – +Vsense

Pin 11 – 5VSB

Pin 12 – GND

Pin 13 – 5VSB

Pin 14 – G_DCOK_C

Pin 15 – GPIOA6

Pin 16 – G_DCOK_E

Pin 17 – GND

Pin 18 – G_ACOK_C

Pin 19 – INH_EN

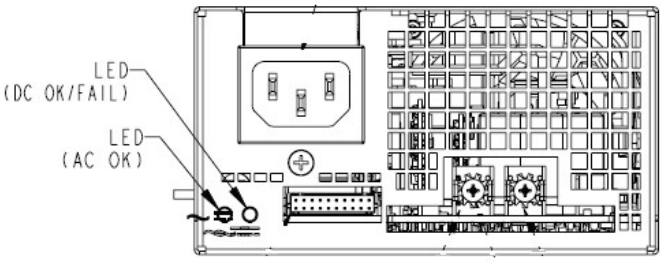
Pin 20 – G_ACOK_E

Power / Signal Mating Connectors and Pin Types

Table 4. Mating Connectors for LCM600 series

Reference	On Power Supply	Mating Connector or Equivalent
AC Input Connector	IEC320-C13	IEC320-C14
SK2	HDR-DR 20WAY CI0120P1HD0-LF	LANDWIN (LWE PN: 2050S) Housing (LWE PN: 2053T) Contact CVILUX (CX PN: CI0120SD000) Housing (CX PN: CI01TD21PE0) Contact
SK3, SK4, SK5, SK6		Screw - PP MC M3.5X6

LED Indicator Definitions



Two user-friendly LEDs for status and diagnostics shows status of input power, output power and alarm condition valuable troubleshooting aid to reduce system downtime.

Condition	LED Conditions	
	ACOK LED	**DCOK/FAIL LED**
AC present / Output On	Green	Green
No AC power to PSU	OFF	OFF
Standby mode/main output off	Green	OFF
Power supply failure	Green	OFF

Weight

The LCM600 series weight is 2.84 lbs (1kg=2.2046lbs) maximum.

Environmental Specifications

EMC Immunity

LCM600 series power supply is designed to meet the following EMC immunity specifications:

Table 6. Environmental Specifications:

Document	Description
EN55022	Conducted and Radiated EMI Limits
EN61000-3-2 Harmonics	Harmonics
EN61000-3-3	Voltage Fluctuations
IEC/EN 61000-4-2	Electromagnetic Compatibility (EMC) - Testing and measurement techniques – Electrostatic discharge immunity test. +/-8KV air, +/-15KV contact discharge, Level 3
IEC/EN 61000-4-3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Radiated, radio-frequency, electromagnetic field immunity test. 80 – 1000 MHz,10V/m, AM 80% (1KHz),900MHz, 10V/M, PM100%(200Hz), Level 3
IEC/EN 61000-4-4	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Electrical Fast Transient/Burst Immunity Test. 2KV for AC power port, 1.0KV for DC ports, I/O and signal ports, Level 3
IEC/EN 61000-4-5	Electromagnetic Compatibility (EMC) - Testing and measurement techniques – 2KV common mode and 1KV differential mode for AC ports and 0.5kV differential mode for DC power, I/O and signal ports, Level 3.
IEC/EN 61000-4-8	Power Freq Magnetic, Level 3
IEC/EN 61000-4-11	Electromagnetic Compatibility (EMC) - Testing and measurement techniques : Voltage Dips and Interruptions: 30% reduction for 500mS- Criteria B>95% reduction for 10mS, Criteria A, >95% reduction for 5000mS, Criteria C
EN55024:1998	Information Technology Equipment-Immunity Characteristics, Limits and Method of Measurements
EN61000-4-6	Conducted RFI for LCM600Q-T-409 only
EN61000-6-2	For LCM600Q-T-409 only

Safety Certifications

The LCM600 series are intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for LCM600 series power supply system

Document	File #	Description
UL/CSA62368-1	E186249-A6047-UL-X10	US and Canada Requirements
EN62368-1	B 013890 3170 Rev. 00	European Requirements
IEC60950-1 IEC60601-1		International Electrotechnical Commission
ES60601-1/CSA C22.2 No. 60601-1	E182560-V4-S2	US and Canada Requirements
EN60601-1		European Requirements
CCC	2012010907546604	China Requiremnets

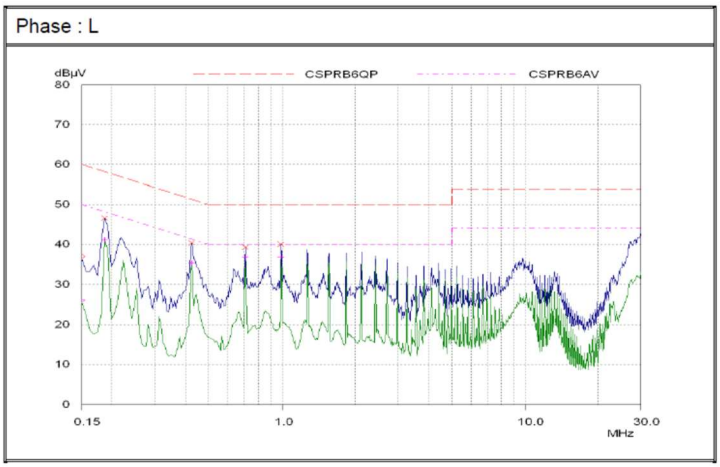
EMI Emissions

The LCM600 series has been designed to comply with the Class B limits of EMI requirements of EN55022 (FCC Part 15) and CISPR 22 (EN55022) for emissions and relevant sections of EN61000 (IEC 61000) for immunity.

The unit is enclosed inside a metal box, tested at 600W using resistive load with cooling fan.

Conducted Emissions

The applicable standard for conducted emissions is EN55022 (FCC Part 15). Conducted noise can appear as both differential mode and common mode noise currents. Differential mode noise is measured between the two input lines, with the major components occurring at the supply fundamental switching frequency and its harmonics. Common mode noise, a contributor to both radiated emissions and input conducted emissions, is measured between the input lines and system ground and can be broadband in nature.



The LCM600 series power supplies have internal EMI ensure the convertors' conducted EMI levels comply with EN55022 (FCC Part 15) Class B and EN55022 (CISPR 22) Class B limits. The EMI measurements are performed with resistive loads at maximum rated loading.

Sample of EN55022 Conducted EMI Measurement at 100Vac input

Note: Red Line refers to Emerson Quasi Peak margin, which is 6dB below the CISPR international limit. Pink Line refers to the Emerson Average margin, which is 6dB below the CISPR international limit.

Conducted Emissions

Table 6. Conducted EMI emission specifications of the LCM600 series

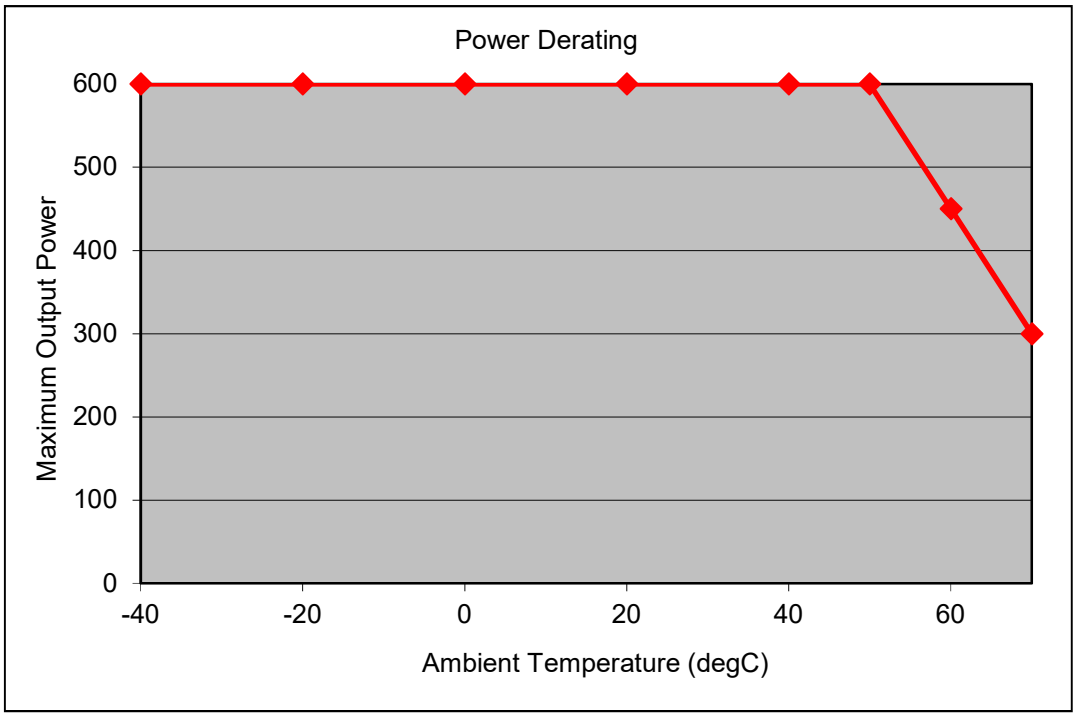
Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	-	-	6	dB
CISPR 22 (EN55022) class B	All	Margin	-	-	6	dB

Radiated Emissions

Unlike conducted EMI, radiated EMI performance in a system environment may differ drastically from that in a stand-alone power supply. The shielding effect provided by the system enclosure may bring the EMI level from Class A to Class B. It is thus recommended that radiated EMI be evaluated in a system environment. The applicable standard is EN55022 Class A (FCC Part 15). Testing ac-dc convertors as a stand-alone component to the exact requirements of EN55022 can be difficult, because the standard calls for 1m leads to be attached to the input and outputs and aligned such as to maximize the disturbance. In such a set-up, it is possible to form a perfect dipole antenna that very few ac-dc convertors could pass. However, the standard also states that 'an attempt should be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample.

Operating Temperature

The LCM600 series maximum output power (600W) can be loaded up to an ambient temperature of +50 ^{O}C. Only 50% (300W) of the maximum output power can be loaded at ambient temp of +70 ^{O}C . Linear derating to 50% nominal output power starts from +50 ^{O}C. The elapsed time between the application of input power and the attainment steady state values requires 5 minutes warm up for –20 ^{O}C to –40 ^{O}C operation.



Forced Air Cooling

The LCM600 series power supplies included internal cooling fans as part of the power supply assembly to provide forced air-cooling to maintain and control temperature of devices and ambient temperature in the power supply to appropriate levels. The standard direction of airflow is from the fan side to the DC output side of the power supply.

The cooling fan is a variable speed fan. Fan will be smart based on internal temperature. Fan noise <45 dBA with 80% load @ 30^{O}C.

Storage and Shipping Temperature / Humidity

The LCM600 series power supplies can be stored or shipped at temperatures between –40 ºC to +85 ºC and relative humidity from 10% to 95% non-condensing.

Altitude

The LCM600 series will operate within specifications at altitudes up to 16,404.2 feet above sea level. The power supply will not be damaged when stored at altitudes of up to 30,000 feet above sea level.

Humidity

The LCM600 series will operate within specifications when subjected to a relative humidity from 20% to 90% non-condensing. The LCM600 series can be stored in a relative humidity from 10% to 95% non-condensing.

Vibration

The LCM600 series will pass the following vibration specifications:

Non-Operating Random Vibration

Acceleration	2.7		gRMS
Frequency Range	10-2000		Hz
Duration	20		mins
Direction	3 mutually perpendicular axis		
PSD Profile	**FREQ** 10-190 Hz 190-210 Hz 210-2000 Hz	**SLOPE dB/oct** --- -31.213dB/oct ---	**PSD g^2/Hz** 0.01 g^2/Hz --- 0.003 g^2/Hz

Operating Random Vibration

Acceleration	1.0		gRMS
Frequency Range	10-500		Hz
Duration	20		mins
Direction	3 mutually perpendicular axis		
PSD Profile	**FREQ** 10-500 Hz	**SLOPE dB/oct** ---	**PSD g^2/Hz** 0.002 g^2/Hz

Shock

The LCM600 series will pass the following vibration specifications:

Non-Operating Half-Sine Shock

Acceleration	30	G
Duration	18	msec
Pulse	Half-Sine	
No. of Shock	3 shock on each of 6 faces	

Operating Half-Sine Shock

Acceleration	4	G
Duration	22	msec
Pulse	Half-Sine	
No. of Shock	3 shock on each of 6 faces	

Power and Control Signal Descriptions

AC Input Connector

This connector supplies the AC Mains to the LCM600 series power supply.

Pin 1 - L1

Pin 2 - L2

Pin 3 - Earth Ground

Output Connector – SK4&SK5

These pins provide the main output for the LCM600 series. The + Main Output (V_O) and the Main Output Return pins are the positive and negative rails, respectively, of the V_O main output of the LCM600 power supply. The Main Output (V_O) is electrically isolated from the power supply chassis.

SK3&SK4 - + Main Output (Vo)

SK5&SK6 - Main Output Return

Control Signals – SK2

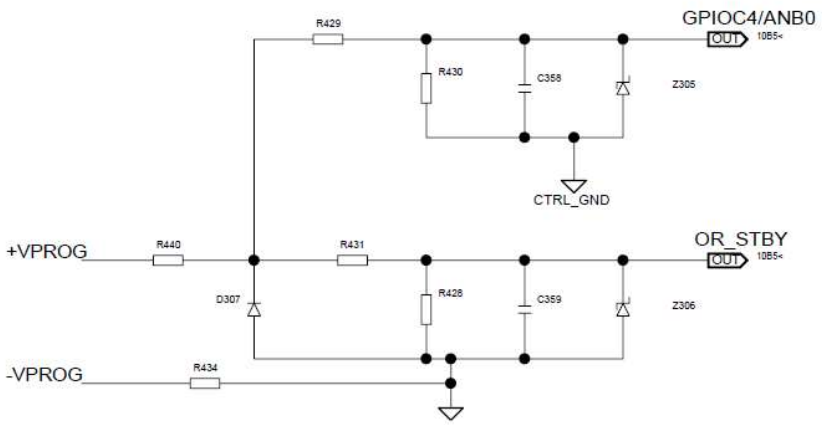
The LCM600 series SK2 contains 20 pins control signal header providing analogy control interface, standby power and I^2C interface.

A0, A1, A2 – (Pin 6, Pin3, Pin1)

Please refer to “Communication Bus Descriptions” section.

-VPROG, +VPROG – (Pin2, Pin8)

Positive and return connection of external supply for Margin Programming. The Power supplies will have a “margin” pin which will accept a 1-6VDC signal referenced to a floating return that will program the output the entire adjustment range. The 1-6VDC signal will be limited to10mA sinking current.



-Vsense, +Vsense – (Pin 4, Pin10)

This remote sense circuit will be designed to compensate for a power path drop around the entire loop of 0.5 volt. These pins should be connected as close to the loading as possible, If left open, the power supply will regulate the voltage at its output terminals but the voltage level at the load may go lower than the guaranteed spec.

ISHARE – (Pin 5)

The main output will have active load sharing. The output will share within 10% at full load. All current sharing functions are implemented internal to the power supply by making use of the ISHARE signal. The system connects the ISHARE lines between the power supplies. The supplies must be able to load share with up to 10 power supplies in parallel. The I^2C Line should be connected separately when the number of units in parallel is more than 8.

SDA1, SCL1, GND– (Pin 7, Pin9, Pin17)

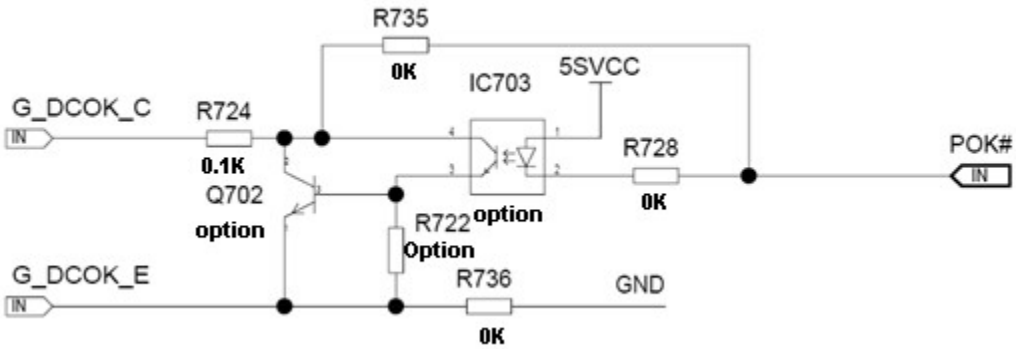
Please refer to “Communication Bus Descriptions” section.

5VSB, GND – (Pin11, Pin12, Pin13)

The LCM600 series provides a regulated 5 volt 2 amp auxiliary output voltage to power critical circuitry that must remain active regardless of the on/off status of the power supply’s main output. The 5VSB standby voltage is available whenever a valid AC input voltage is applied to the unit.

G_DCOK_C, G_DCOK_E– (Pin14, Pin16)

G_DCOK_C is a power good signal and will be pulled LOW by the power supply to indicate that both the outputs are above the regulation limits of the power supply. When any output voltage falls below regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, G_DCOK_C will be de-asserted to a HIGH state. Connect 4.7K resistor on G_DCOK_C to PSU’s 5V stand-by.

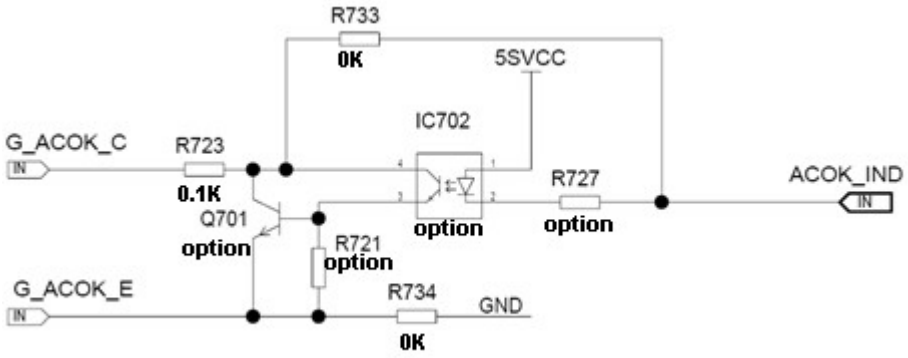


GPIOA6 – (Pin15)

EEPROM Write Protect

G_ACOK_C, G_ACOK_E– (Pin18, Pin20)

G-ACOK_C signal is used to indicate presence of AC input to the power supply. A logic “Low” level on this signal will indicate AC input to the power supply is present. A Logic “High” on this signal will indicate a loss of AC input to the power supply. Connect 4.7K resistor on G_ACOK_C to external 5V power .



INH_EN – (Pin19)

This signal is required to remotely turn on/off the power supply. When INH_EN is shorted to secondary common, the PSU main output shall turn OFF, otherwise the main output is ON.

Communication Bus Descriptions

I²C Bus Signals

The LCM600 series power supply contains enhanced monitor and control functions implemented via the I²C bus. The LCM600 series I²C functionality (PMBus™ and FRU data) can be accessed via the output connector control signals. The communication bus is powered either by the internal 3.3V supply or from an external power source connected to the StandBy Output (ie: accessing an unpowered power supply as long as the StandBy Output of another power supply connected in parallel is on).

If units are connected in parallel or in redundant mode, the StandBy Outputs must be connected together in the system. Otherwise, the I²C bus will not work properly when a unit is inserted into the system without the AC source connected.

Note: PMBus™ functionality can be accessed only when the PSU is powered-up.
Guaranteed communication I²C speed is 100KHz.

SDA, SCL (I²C Data and Clock Signals) – (pin7, pin 9)

I²C serial data and clock bus - these pins are internally pulled up to internal 3.3V supply with a 4.7K ohm resistor. These pins must be pulled-up in the system by an 2.2K ohm resistor to the 3.3V supply.

A0, A1, A2 (I²C Address BIT 0, BIT1, BIT2 Signals) – (pin6, pin3, pin1)

These three input pins are the address lines A0, A1 and A2 to the power supply addresses for FRU data and PMBus™ data communication. This allows the system to assign different addresses for each power supply. During I²C communication between system and power supplies, the system will be the master and power supplies will be slave.

They are internally pulled up to internal 5V supply with 2K ohm resistors and voltage limited to 2.7V with zener diodes.

I²C Bus Communication Interval

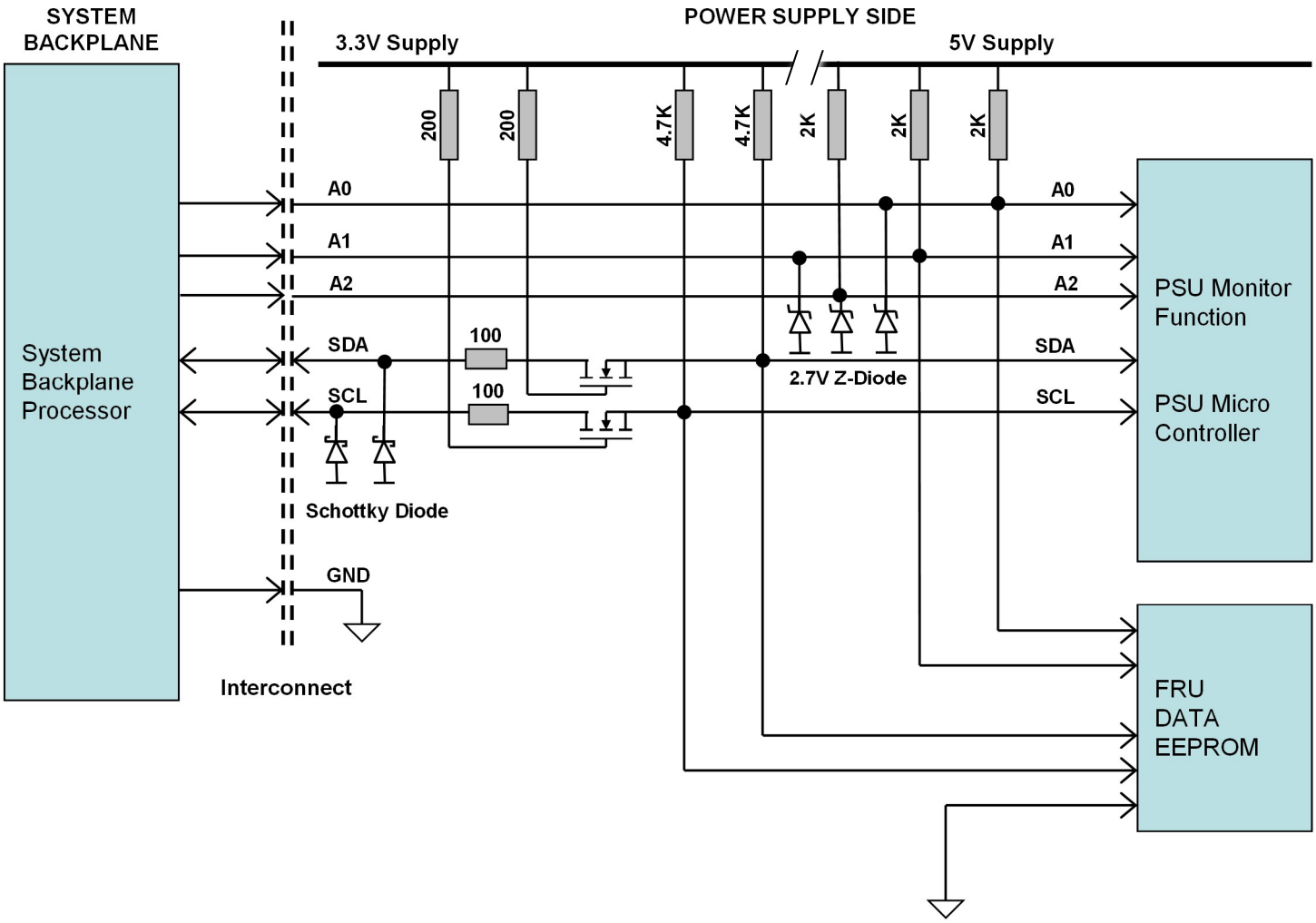
The interval between two consecutive I²C communications to the power supply should be at least 50ms to ensure proper monitoring functionality.

I²C Bus Signal Integrity

The noise on the I²C bus (SDA, SCL lines) due to the power supply will be less than 500mV peak-to-peak. This noise measurement should be made with an oscilloscope bandwidth limited to 100MHz. Measurements should be make at the power supply output connector with 2.2K ohm resistors pulled up to StandBy Output and 100pf ceramic capacitors to StandBy Output Return.

The noise on the address lines A0 will be less than 100mV peak-to-peak. This noise measurement should be made at the power supply output connector.

I²C Bus Internal Implementation, Pull-ups and Bus Capacitances



I²C Bus - Recommended external pull-ups:

Electrical and Interface specifications of I²C signals (referenced to StandBy Output Return pin, unless otherwise indicated):

Parameter	Condition	Symbol	Min	Typ	Max	Unit
SDA, SCL internal pull-up resistor		R_{int}	-	4.7	-	Kohm
SDA, SCL internal bus capacitance		C_{int}	-	0	-	pF
Recommended external pull-up resistor 1 PSU	1 PSU	R_{ext}	-	2.2K	-	ohm
	2 PSU		-	1.1K	-	ohm

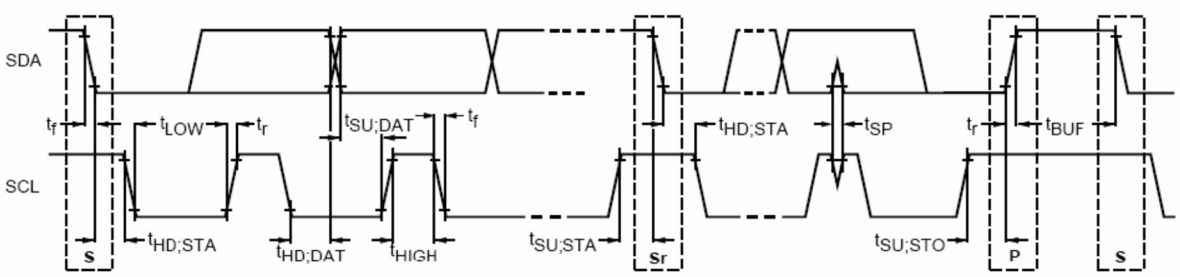
Logic Levels

LCM600 series power supply I²C Communication Bus will respond to logic levels as per below:

Logic High: 5.1V Nominal (Specs is 2.1V to 5.5V)**
Logic Low: 500mV nominal (Specs is 800mV max)**

** Note: Philips™ I²C adapter was used.

Timings



Parameter	Symbol	Standard-Mode Soecs		Actual		Unit
		Min	Max			
SCL Clock Frequency	f_{SCL}	0	100	95		kHz
Hold time (repeated) START condition	$t_{HD;STA}$	4.0	-	4.6		us
LOW period of SCL clock	t_{LOW}	4.7	-	4.7		us
HIGH period of SCL clock	t_{HIGH}	4.0	-	4.2		us
Setup time for repeated START condition	$t_{SU;STA}$	4.7	-	4.7		us
Data hold time	$t_{HD;DAT}$	0	3.45	0.5		us
Data setup time	$t_{SU;DAT}$	250	-	4000		ns
Rise time	t_r	-	1000	SCL =890	SDA =915	ns
Fall time	t_f	-	300	SCL =285	SDA =590	ns
Setup time for STOP condition	$t_{SU;STO}$	4.0	-	5.8		us
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	69		us

*** Note Philips™ I²C adapter and bundled software (USB-to-I²C) was used

Device Addressing

The LCM600 series will respond to supported commands on the I²C bus that are addressed according to pins A0, A1 and A2 of the output connector.

Address pins are held HIGH by default via pull up to internal 5V supply with a 2K ohm resistor and voltage limited to 2.7V with zener diodes. To set the address as “0”, the corresponding address line should be pulled down to logic ground level. Below tables show the address of the power supply with A0, A1 and A2 pins set to either “0” or “1”.

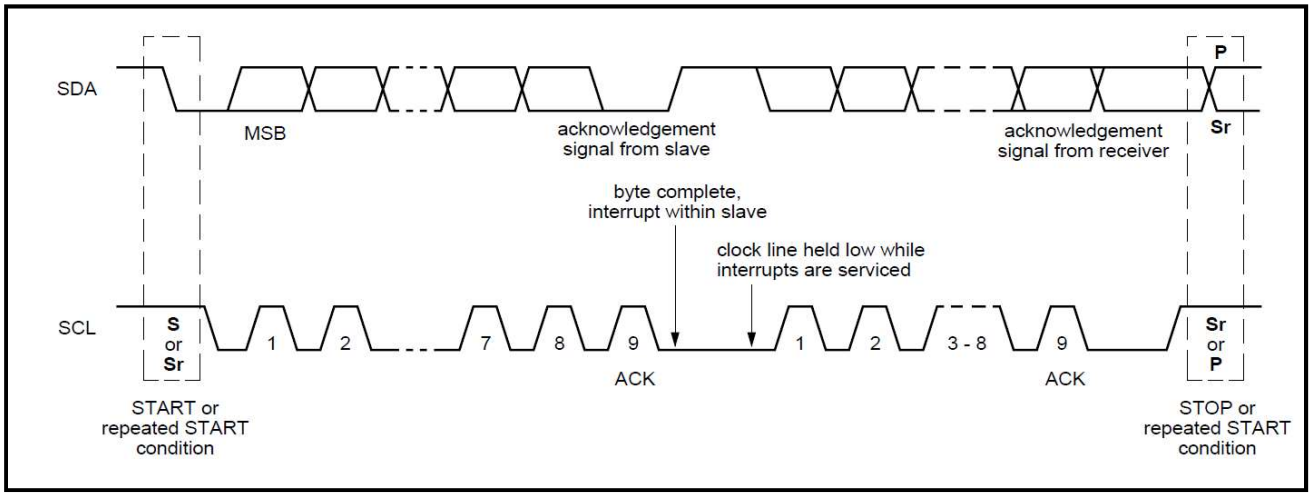
PSU Slot	Slot ID Bits			PMBus™ Address
	A0	A1	A2	
1	0	0	0	B0
2	0	0	1	B2
3	0	1	0	B4
4	0	1	1	B6
5	1	0	0	B8
6	1	0	1	BA
7	1	1	0	BC
8	1	1	1	BE*

* Default PMBus™ address is BE (B2 on some models with A0 ONLY addressing)

I²C Clock Synchronization

The LCM600 series power supply might apply clock stretching. An addressed slave power supply may hold the clock line (SCL) low after receiving (or sending) a byte, indicating that it is not yet ready to process more data. The system master that is communicating with the power supply will attempt to raise the clock to transfer the next bit, but must verify that the clock line was actually raised. If the power supply is clock stretching, the clock line will still be low (because the connections are open-drain).

The maximum time out condition for clock stretching for LCM600 series is 100 microseconds.



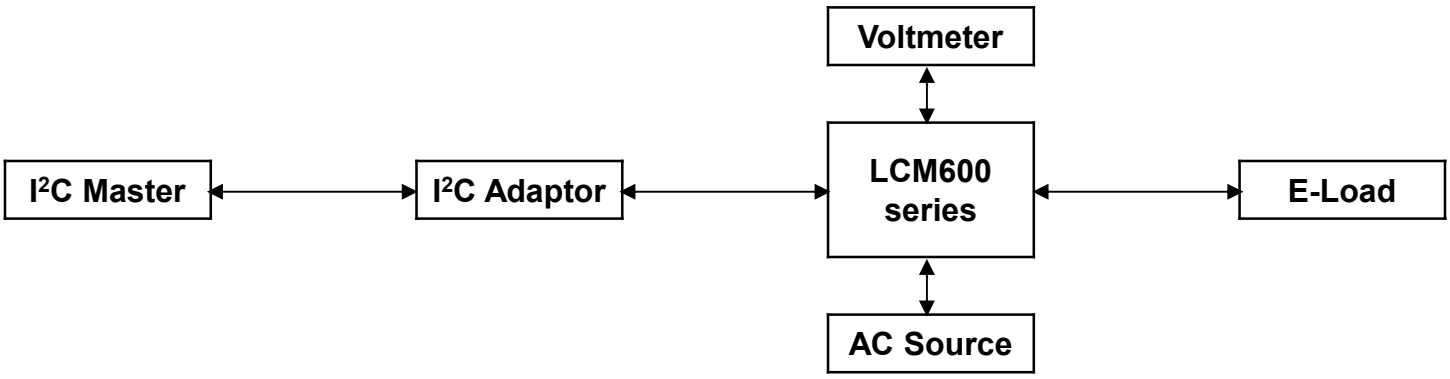
PMBus™ Interface Support

The LCM600 series is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

LCM600 series PMBus™ General Instructions

Equipment Setup

The following is typical I²C communication setup:



PMBus™ Writing Instructions

When writing to any PMBus™ R/W registers, ALWAYS do the following:

Disable Write Protect (command 10h) by writing any of the following accordingly:

Levels: 00h – Enable writing to all writeable commends

20h – Disables write except 10h, 01h, 00h, 02h and 21h commands

40h – Disables write except 10h, 01h, and 00h commends

80h – Disable write except 0x00h

To save changes on the USER PMBus™ Table:

Use send byte command: 15h STORE_USER_ALL

Wait for 5 seconds, turn-off the PSU, wait for another 5 seconds before turning it on.

LCM600 Support PMBus™ Command List

The LCM600 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

LCM600 series Supported PMBus™ Command List: (the default value shown in below table is for LCM600L model only)

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
03h	CLEAR_FAULTS	-	S	1		
10h	WRITE_PROTECT	00	R/W	1	MSF	Used to Control Writing to the PMBus Device 80h - Disables write except 10h 40h – Disables write except 10h, 01h, 00h 20h – Disables write except 10h,01h,00h,02h and 21h commands 00 – Enables write to all writeable commands.
15h	STORE_USER_ALL	-	S	0		Copies the Operating memory table to the matching USER non-volatile memory.
20h	VOUT_MODE	17	R	1	Linear	Specifies the mode and parameters of Output Voltage related Data Formats
24h	VOUT_MAX		R	2	Linear	Sets the max adjustable output voltage limit. 14.688V
31h	POUT_MAX		R	2	Linear	Sets the operating power limit condition. 600W
40h	VOUT_OV_FAULT_LIMIT		R/W	2	Linear	Sets Output Over voltage threshold. (15V)
41h	VOUT_OV_FAULT_RESPONSE	C0	R	1	MSF	Unit Latches OFF. Resets on PSON or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT		R	2	Linear	Sets Over-voltage Warning threshold. (14.699V)
43h	VOUT_UV_WARN_LIMIT		R	2	Linear	Sets Under-voltage Warning threshold. (7.949V)
44h	VOUT_UV_FAULT_LIMIT		R	2	Linear	Sets Under-voltage Fault threshold. (7.559V)
45h	VOUT_UV_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT		R	2	Linear	Sets the Over current threshold in Amps. (55A)
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1	MSF	OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT		R	2	Linear	Sets the Over Current Warning threshold in Amps. (54.5A)
4Fh	OT_FAULT_LIMIT		R	2	Linear	Secondary ambient temperature Fault threshold, in degree C. (130degC)
50h	OT_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT		R	2	Linear	Secondary ambient temperature warning threshold, in degree C. Operating limit. (125 degC)
5Eh	POWER_GOOD_ON		R	2	Linear	Sets the threshold by which the Power Good signal is asserted. (8.209V)
5Fh	POWER_GOOD_OFF		R	2	Linear	Sets the threshold by which the Power Good signal is de-asserted. (7.209V)
60h	TON_DELAY		R	2	Linear	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (1600mS)
61h	TON_RISE		R	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. (200ms)

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value (HEX)	Access Type	Data Bytes	Data Format	Description
64h	TOFF_DELAY		R	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(20ms)
78h	STATUS_BYTE	00	R	1	Binary	Returns the summary of critical faults
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under--voltage fault has occurred
	b2 - TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE OF THE ABOVE					A Fault Warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD	0000	R	2	Binary	Summary of units Fault and warning status.
	b15 – VOUT					An output voltage fault or warning has occurred
	b14 – IOUT/POUT					An Output current or power fault or warning has occurred.
	b13 – INPUT					An input voltage, current or power fault or warning as occurred.
	b12 – MFR					A manufacturer specific fault or warning has occurred.
	b11 – POWER_GOOD#					The POWER_GOOD signal is de-asserted
	b10 - FANS					Not support.
	b9 – OTHER					A bit in STATUS_OTHER is set.
	b8 – UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under-voltage fault has occurred
	b2 – TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.
7Ah	STATUS_VOUT	00	R	1	Binary	Output voltage related faults and warnings
	b7					VOUT Over--voltage Fault
	b6					VOUT Over-voltage warning
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Bh	STATUS_IOUT	00	R	1	Binary	Output Current related faults and warnings
	b7					IOUT Over current Fault
	b6					IOUT Over current And Low Voltage shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Dh	STATUS_TEMPERATURE	00	R	1	Binary	Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature Fault
	b3:0					reserved
8Bh	READ_VOUT	-	R	2	Linear	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Linear	Returns the output current in amperes.
8Dh	READ_TEMPERATURE_1	-	R	2	Linear	
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
99h	MFR_ID		R/W	7	ASCII	
9Ah	MFR_MODEL	4C,43,4D,36,30,30,4C	R/W	7	ASCII	LCM600L
9Bh	MFR_REVISION	41,45	R/W	2	ASCII	
9Ch	MFR_LOCATION	4C,41,47,55,4E,41	R/W	6	ASCII	Laguna
9Eh	MFR_DATE		R/W	13	ASCII	13 CHAR
A0h	MFR_VIN_MIN		R	2	Linear	Minimum Input Voltage (100Vac)
A1h	MFR_VIN_MAX		R	2	Linear	Maximum Input Voltage (240Vac)
A2h	MFR_IIN_MAX		R	2	Linear	Maximum Input Current (8.5A)
A4h	MFR_VOUT_MIN		R	2	Linear	Minimum Output Voltage Regulation Window. (9.408V)
A5h	MFR_VOUT_MAX		R	2	Linear	Maximum Output Voltage. Regulation Window (14.688V)
A6h	MFR_IOUT_MAX		R	2	Linear	Maximum Output Current (52A)
A7h	MFR_POUT_MAX		R	2	Linear	Maximum Output Power(600W)
A8h	MFR_TAMBIENT_MAX		R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient) (70 degC)
A9h	MFR_TAMBIENT_MIN		R	2	Linear	Minimum Operating Ambient Temperature (Secondary Ambient) (-40 degC)
D5h	Code revision		R	8	ASCII	

LCM600 Support PMBus™ Command List

The LCM600 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

LCM600 series Supported PMBus™ Command List: (the default value shown in below table is for LCM600N model only)

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
03h	CLEAR_FAULTS	-	S	1		
10h	WRITE_PROTECT	00	R/W	1	MSF	Used to Control Writing to the PMBus Device 80h - Disables write except 10h 40h – Disables write except 10h, 01h, 00h 20h – Disables write except 10h,01h,00h,02h and 21h commands 00 – Enables write to all writeable commands.
15h	STORE_USER_ALL	-	S	0		Copies the Operating memory table to the matching USER non-volatile memory.
20h	VOUT_MODE	17	R	1	Linear	Specifies the mode and parameters of Output Voltage related Data Formats
24h	VOUT_MAX		R	2	Linear	Sets the max adjustable output voltage limit. 19.889V
31h	POUT_MAX		R	2	Linear	Sets the operating power limit condition. 600W
40h	VOUT_OV_FAULT_LIMIT		R/W	2	Linear	Sets Output Over voltage threshold. (21.2V)
41h	VOUT_OV_FAULT_RESPONSE	C0	R	1	MSF	Unit Latches OFF. Resets on PSON or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT		R	2	Linear	Sets Over-voltage Warning threshold. (20.199V)
43h	VOUT_UV_WARN_LIMIT		R	2	Linear	Sets Under-voltage Warning threshold. (13.818V)
44h	VOUT_UV_FAULT_LIMIT		R	2	Linear	Sets Under-voltage Fault threshold. (13.148V)
45h	VOUT_UV_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT		R	2	Linear	Sets the Over current threshold in Amps. (44.875A)
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1	MSF	OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT		R	2	Linear	Sets the Over Current Warning threshold in Amps. (44.375A)
4Fh	OT_FAULT_LIMIT		R	2	Linear	Secondary ambient temperature Fault threshold, in degree C. (130degC)
50h	OT_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT		R	2	Linear	Secondary ambient temperature warning threshold, in degree C. Operating limit. (125 degC)
5Eh	POWER_GOOD_ON		R	2	Linear	Sets the threshold by which the Power Good signal is asserted. (14.27V)
5Fh	POWER_GOOD_OFF		R	2	Linear	Sets the threshold by which the Power Good signal is de-asserted. (13.27V)
60h	TON_DELAY		R	2	Linear	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (1600mS)
61h	TON_RISE		R	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. (200ms)

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value (HEX)	Access Type	Data Bytes	Data Format	Description
64h	TOFF_DELAY		R	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(20ms)
78h	STATUS_BYTE	00	R	1	Binary	Returns the summary of critical faults
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under--voltage fault has occurred
	b2 - TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE OF THE ABOVE					A Fault Warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD	0000	R	2	Binary	Summary of units Fault and warning status.
	b15 – VOUT					An output voltage fault or warning has occurred
	b14 – IOUT/POUT					An Output current or power fault or warning has occurred.
	b13 – INPUT					An input voltage, current or power fault or warning as occurred.
	b12 – MFR					A manufacturer specific fault or warning has occurred.
	b11 – POWER_GOOD#					The POWER_GOOD signal is de-asserted
	b10 - FANS					Not support.
	b9 – OTHER					A bit in STATUS_OTHER is set.
	b8 – UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under-voltage fault has occurred
	b2 – TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.
7Ah	STATUS_VOUT	00	R	1	Binary	Output voltage related faults and warnings
	b7					VOUT Over--voltage Fault
	b6					VOUT Over-voltage warning
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Bh	STATUS_IOUT	00	R	1	Binary	Output Current related faults and warnings
	b7					IOUT Over current Fault
	b6					IOUT Over current And Low Voltage shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Dh	STATUS_TEMPERATURE	00	R	1	Binary	Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature Fault
	b3:0					reserved
81h	STATUS_FANS_1_2	00	R	1	Binary	
8Bh	READ_VOUT	-	R	2	Linear	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Linear	Returns the output current in amperes.
8Dh	READ_TEMPERATURE_1	-	R	2	Linear	
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
99h	MFR_ID		R/W	7	ASCII	
9Ah	MFR_MODEL	4C,43,4D,36,30,30,4E	R/W	7	ASCII	LCM600N
9Bh	MFR_REVISION	41,43	R/W	2	ASCII	
9Ch	MFR_LOCATION	4C,41,47,55,4E,41	R/W	6	ASCII	Laguna
9Eh	MFR_DATE		R/W	13	ASCII	13 CHAR
A0h	MFR_VIN_MIN		R	2	Linear	Minimum Input Voltage (100Vac)
A1h	MFR_VIN_MAX		R	2	Linear	Maximum Input Voltage (240Vac)
A2h	MFR_IIN_MAX		R	2	Linear	Maximum Input Current (8.5A)
A4h	MFR_VOUT_MIN		R	2	Linear	Minimum Output Voltage Regulation Window. (11.76V)
A5h	MFR_VOUT_MAX		R	2	Linear	Maximum Output Voltage. Regulation Window (19.889V)
A6h	MFR_IOUT_MAX		R	2	Linear	Maximum Output Current (44A)
A7h	MFR_POUT_MAX		R	2	Linear	Maximum Output Power(600W)
A8h	MFR_TAMBIENT_MAX		R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient) (70 degC)
A9h	MFR_TAMBIENT_MIN		R	2	Linear	Minimum Operating Ambient Temperature (Secondary Ambient) (-40 degC)
D5h	Code revision		R	8	ASCII	

LCM600 Support PMBus™ Command List

The LCM600 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

LCM600 series Supported PMBus™ Command List: (the default value shown in below table is for LCM600Q model only)

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
03h	CLEAR_FAULTS	-	S	1		
10h	WRITE_PROTECT	80	R/W	1	MSF	Used to Control Writing to the PMBus Device 80h - Disables write except 10h 40h – Disables write except 10h, 01h, 00h 20h – Disables write except 10h,01h,00h,02h and 21h commands 00 – Enables write to all writeable commands.
15h	STORE_USER_ALL	-	S	0		Copies the Operating memory table to the matching USER non-volatile memory.
20h	VOUT_MODE	17	R	1	Linear	Specifies the mode and parameters of Output Voltage related Data Formats
24h	VOUT_MAX	30F6	R	2	Linear	Sets the max adjustable output voltage limit. 24.48V
31h	POUT_MAX	0258	R	2	Linear	Sets the operating power limit condition. 600W
40h	VOUT_OV_FAULT_LIMIT	3E00	R/W	2	Linear	Sets Output Over voltage threshold. (31V)
41h	VOUT_OV_FAULT_RESPONSE	C0	R	1	MSF	Unit Latches OFF. Resets on PSON or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT	3C00	R	2	Linear	Sets Over-voltage Warning threshold. (30V)
43h	VOUT_UV_WARN_LIMIT	2400	R	2	Linear	Sets Under-voltage Warning threshold. (18V)
44h	VOUT_UV_FAULT_LIMIT	1E00	R	2	Linear	Sets Under-voltage Fault threshold. (15V)
45h	VOUT_UV_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT	DB80	R	2	Linear	Sets the Over current threshold in Amps. (28A)
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1	MSF	OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT	DB50	R	2	Linear	Sets the Over Current Warning threshold in Amps. (26.5A)
4Fh	OT_FAULT_LIMIT	EB98	R	2	Linear	Secondary ambient temperature Fault threshold, in degree C. (115degC)
50h	OT_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT	EB70	R	2	Linear	Secondary ambient temperature warning threshold, in degree C. Operating limit. (110 degC)
5Eh	POWER_GOOD_ON	2600	R	2	Linear	Sets the threshold by which the Power Good signal is asserted. (19V)
5Fh	POWER_GOOD_OFF	2400	R	2	Linear	Sets the threshold by which the Power Good signal is de-asserted. (18V)
60h	TON_DELAY	BB33	R	2	Linear	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (1600mS)
61h	TON_RISE	9A66	R	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. (200ms)

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value (HEX)	Access Type	Data Bytes	Data Format	Description
64h	TOFF_DELAY	8A8F	R	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(20ms)
78h	STATUS_BYTE	00	R	1	Binary	Returns the summary of critical faults
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under--voltage fault has occurred
	b2 - TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE OF THE ABOVE					A Fault Warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD	0000	R	2	Binary	Summary of units Fault and warning status.
	b15 – VOUT					An output voltage fault or warning has occurred
	b14 – IOUT/POUT					An Output current or power fault or warning has occurred.
	b13 – INPUT					An input voltage, current or power fault or warning as occurred.
	b12 – MFR					A manufacturer specific fault or warning has occurred.
	b11 – POWER_GOOD#					The POWER_GOOD signal is de-asserted
	b10 - FANS					Not support.
	b9 – OTHER					A bit in STATUS_OTHER is set.
	b8 – UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under-voltage fault has occurred
	b2 – TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.
7Ah	STATUS_VOUT	00	R	1	Binary	Output voltage related faults and warnings
	b7					VOUT Over--voltage Fault
	b6					VOUT Over-voltage warning
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Bh	STATUS_IOUT	00	R	1	Binary	Output Current related faults and warnings
	b7					IOUT Over current Fault
	b6					IOUT Over current And Low Voltage shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Dh	STATUS_TEMPERATURE	00	R	1	Binary	Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature Fault
	b3:0					reserved
8Bh	READ_VOUT	-	R	2	Linear	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Linear	Returns the output current in amperes.
8Dh	READ_TEMPERATURE_2	-	R	2	Linear	
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
99h	MFR_ID		R/W	7	ASCII	
9Ah	MFR_MODEL	07,4C,43,4D,36,30,30,51	R/W	7	ASCII	LCM600Q
9Bh	MFR_REVISION	02,20,20	R/W	2	ASCII	
9Ch	MFR_LOCATION	06,4C,61,67,75,6E,61	R/W	6	ASCII	Laguna
9Eh	MFR_DATE		R/W	13	ASCII	13 CHAR
A0h	MFR_VIN_MIN	EB20	R	2	Linear	Minimum Input Voltage (100Vac)
A1h	MFR_VIN_MAX	F3C0	R	2	Linear	Maximum Input Voltage (240Vac)
A2h	MFR_IIN_MAX	D220	R	2	Linear	Maximum Input Current (8.5A)
A4h	MFR_VOUT_MIN	2F0A	R	2	Linear	Minimum Output Voltage Regulation Window. (23.52V)
A5h	MFR_VOUT_MAX	30F6	R	2	Linear	Maximum Output Voltage. Regulation Window (24.48V)
A6h	MFR_IOUT_MAX	DB20	R	2	Linear	Maximum Output Current (25A)
A7h	MFR_POUT_MAX	0258	R	2	Linear	Maximum Output Power(600W)
A8h	MFR_TAMBIENT_MAX	EA30	R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient) (70 degC)
A9h	MFR_TAMBIENT_MIN	E580	R	2	Linear	Minimum Operating Ambient Temperature (Secondary Ambient) (-40 degC)
D5h	Code revision		R	8	ASCII	

LCM600 Support PMBus™ Command List

The LCM600 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

LCM600 series Supported PMBus™ Command List: (the default value shown in below table is for LCM600U model only)

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
03h	CLEAR_FAULTS	-	S	1		
10h	WRITE_PROTECT	00	R/W	1	MSF	Used to Control Writing to the PMBus Device 80h - Disables write except 10h 40h – Disables write except 10h, 01h, 00h 20h – Disables write except 10h,01h,00h,02h and 21h commands 00 – Enables write to all writeable commands.
15h	STORE_USER_ALL	-	S	0		Copies the Operating memory table to the matching USER non-volatile memory.
20h	VOUT_MODE	17	R	1	Linear	Specifies the mode and parameters of Output Voltage related Data Formats
24h	VOUT_MAX		R	2	Linear	Sets the max adjustable output voltage limit. 43.2V
31h	POUT_MAX		R	2	Linear	Sets the operating power limit condition. 600W
40h	VOUT_OV_FAULT_LIMIT		R/W	2	Linear	Sets Output Over voltage threshold. (49V)
41h	VOUT_OV_FAULT_RESPONSE	C0	R	1	MSF	Unit Latches OFF. Resets on PSON or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT		R	2	Linear	Sets Over-voltage Warning threshold. (44.059V)
43h	VOUT_UV_WARN_LIMIT		R	2	Linear	Sets Under-voltage Warning threshold. (33.318V)
44h	VOUT_UV_FAULT_LIMIT		R	2	Linear	Sets Under-voltage Fault threshold. (31.689V)
45h	VOUT_UV_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT		R	2	Linear	Sets the Over current threshold in Amps. (19A)
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1	MSF	OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT		R	2	Linear	Sets the Over Current Warning threshold in Amps. (18.5A)
4Fh	OT_FAULT_LIMIT		R	2	Linear	Secondary ambient temperature Fault threshold, in degree C. (125degC)
50h	OT_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT		R	2	Linear	Secondary ambient temperature warning threshold, in degree C. Operating limit. (110 degC)
5Eh	POWER_GOOD_ON		R	2	Linear	Sets the threshold by which the Power Good signal is asserted. (34.398V)
5Fh	POWER_GOOD_OFF		R	2	Linear	Sets the threshold by which the Power Good signal is de-asserted. (33.398V)
60h	TON_DELAY		R	2	Linear	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (1600mS)
61h	TON_RISE		R	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. (200ms)

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value (HEX)	Access Type	Data Bytes	Data Format	Description
64h	TOFF_DELAY		R	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(20ms)
78h	STATUS_BYTE	00	R	1	Binary	Returns the summary of critical faults
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under--voltage fault has occurred
	b2 - TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE OF THE ABOVE					A Fault Warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD	0000	R	2	Binary	Summary of units Fault and warning status.
	b15 – VOUT					An output voltage fault or warning has occurred
	b14 – IOUT/POUT					An Output current or power fault or warning has occurred.
	b13 – INPUT					An input voltage, current or power fault or warning as occurred.
	b12 – MFR					A manufacturer specific fault or warning has occurred.
	b11 – POWER_GOOD#					The POWER_GOOD signal is de-asserted
	b10 - FANS					Not support.
	b9 – OTHER					A bit in STATUS_OTHER is set.
	b8 – UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under-voltage fault has occurred
	b2 – TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.
7Ah	STATUS_VOUT	00	R	1	Binary	Output voltage related faults and warnings
	b7					VOUT Over--voltage Fault
	b6					VOUT Over-voltage warning
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Bh	STATUS_IOUT	00	R	1	Binary	Output Current related faults and warnings
	b7					IOUT Over current Fault
	b6					IOUT Over current And Low Voltage shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Dh	STATUS_TEMPERATURE	00	R	1	Binary	Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature Fault
	b3:0					reserved
8Bh	READ_VOUT	-	R	2	Linear	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Linear	Returns the output current in amperes.
8Dh	READ_TEMPERATURE_1	-	R	2	Linear	
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
99h	MFR_ID		R/W	7	ASCII	
9Ah	MFR_MODEL	4C,43,4D,36,30,30,55	R/W	7	ASCII	LCM600U
9Bh	MFR_REVISION	41,41	R/W	2	ASCII	
9Ch	MFR_LOCATION	4C,41,47,55,4E,41	R/W	6	ASCII	Laguna
9Eh	MFR_DATE		R/W	13	ASCII	13 CHAR
A0h	MFR_VIN_MIN		R	2	Linear	Minimum Input Voltage (100Vac)
A1h	MFR_VIN_MAX		R	2	Linear	Maximum Input Voltage (240Vac)
A2h	MFR_IIN_MAX		R	2	Linear	Maximum Input Current (9A)
A4h	MFR_VOUT_MIN		R	2	Linear	Minimum Output Voltage Regulation Window. (28.8V)
A5h	MFR_VOUT_MAX		R	2	Linear	Maximum Output Voltage. Regulation Window (43.2V)
A6h	MFR_IOUT_MAX		R	2	Linear	Maximum Output Current (18A)
A7h	MFR_POUT_MAX		R	2	Linear	Maximum Output Power(600W)
A8h	MFR_TAMBIENT_MAX		R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient) (70 degC)
A9h	MFR_TAMBIENT_MIN		R	2	Linear	Minimum Operating Ambient Temperature (Secondary Ambient) (-40 degC)
D5h	Code revision		R	8	ASCII	

LCM600 Support PMBus™ Command List

The LCM600 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

LCM600 series Supported PMBus™ Command List: (the default value shown in below table is for LCM600W model only)

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
03h	CLEAR_FAULTS	-	S	1		
10h	WRITE_PROTECT	00	R/W	1	MSF	Used to Control Writing to the PMBus Device 80h - Disables write except 10h 40h – Disables write except 10h, 01h, 00h 20h – Disables write except 10h,01h,00h,02h and 21h commands 00 – Enables write to all writeable commands.
15h	STORE_USER_ALL	-	S	0		Copies the Operating memory table to the matching USER non-volatile memory.
20h	VOUT_MODE	17	R	1	Linear	Specifies the mode and parameters of Output Voltage related Data Formats
24h	VOUT_MAX		R	2	Linear	Sets the max adjustable output voltage limit. 56V
31h	POUT_MAX		R	2	Linear	Sets the operating power limit condition. 600W
46h	IOUT_OC_FAULT_LIMIT		R	2	Linear	Sets the Over current threshold in Amps. (13.797A)
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1	MSF	OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT		R	2	Linear	Sets the Over Current Warning threshold in Amps. (13.297A)
4Fh	OT_FAULT_LIMIT		R	2	Linear	Secondary ambient temperature Fault threshold, in degree C. (115degC)
50h	OT_FAULT_RESPONSE	C0	R	1	MSF	Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT		R	2	Linear	Secondary ambient temperature warning threshold, in degree C. Operating limit. (110 degC)
5Eh	POWER_GOOD_ON		R	2	Linear	Sets the threshold by which the Power Good signal is asserted. (41.828V)
5Fh	POWER_GOOD_OFF		R	2	Linear	Sets the threshold by which the Power Good signal is de-asserted. (40.828V)
60h	TON_DELAY		R	2	Linear	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (1600mS)
61h	TON_RISE		R	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. (200ms)

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value (HEX)	Access Type	Data Bytes	Data Format	Description
64h	TOFF_DELAY	8A8F	R	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(20ms)
78h	STATUS_BYTE	00	R	1	Binary	Returns the summary of critical faults
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under--voltage fault has occurred
	b2 - TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE OF THE ABOVE					A Fault Warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD	0000	R	2	Binary	Summary of units Fault and warning status.
	b15 – VOUT					An output voltage fault or warning has occurred
	b14 – IOUT/POUT					An Output current or power fault or warning has occurred.
	b13 – INPUT					An input voltage, current or power fault or warning as occurred.
	b12 – MFR					A manufacturer specific fault or warning has occurred.
	b11 – POWER_GOOD#					The POWER_GOOD signal is de-asserted
	b10 - FANS					Not support.
	b9 – OTHER					A bit in STATUS_OTHER is set.
	b8 – UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under-voltage fault has occurred
	b2 – TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.
7Ah	STATUS_VOUT	00	R	1	Binary	Output voltage related faults and warnings
	b7					VOUT Over--voltage Fault
	b6					VOUT Over-voltage warning
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved

LCM600 Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Bh	STATUS_IOUT	00	R	1	Binary	Output Current related faults and warnings
	b7					IOUT Over current Fault
	b6					IOUT Over current And Low Voltage shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Dh	STATUS_TEMPERATURE	00	R	1	Binary	Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature Fault
	b3:0					reserved
81h	STATUS_FANS_1_2	00	R	1	Binary	
8Bh	READ_VOUT	-	R	2	Linear	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Linear	Returns the output current in amperes.
8Dh	READ_TEMPERATURE_2	-	R	2	Linear	
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
99h	MFR_ID		R/W	7	ASCII	
9Ah	MFR_MODEL	4C,43,40,36,30,30,57	R/W	7	ASCII	LCM600W
9Bh	MFR_REVISION	30,30	R/W	2	ASCII	
9Ch	MFR_LOCATION	4C,41,47,55,4E,41	R/W	6	ASCII	Laguna
9Eh	MFR_DATE		R/W	13	ASCII	13 CHAR
A0h	MFR_VIN_MIN		R	2	Linear	Minimum Input Voltage (100Vac)
A1h	MFR_VIN_MAX		R	2	Linear	Maximum Input Voltage (240Vac)
A2h	MFR_IIN_MAX		R	2	Linear	Maximum Input Current (9A)
A4h	MFR_VOUT_MIN		R	2	Linear	Minimum Output Voltage Regulation Window. (36V)
A5h	MFR_VOUT_MAX		R	2	Linear	Maximum Output Voltage. Regulation Window (56V)
A6h	MFR_IOUT_MAX		R	2	Linear	Maximum Output Current (13A)
A7h	MFR_POUT_MAX		R	2	Linear	Maximum Output Power(600W)
A8h	MFR_TAMBIENT_MAX		R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient) (70 degC)
A9h	MFR_TAMBIENT_MIN		R	2	Linear	Minimum Operating Ambient Temperature (Secondary Ambient) (-40 degC)
D5h	Code revision		R	8	ASCII	

Application Notes

Current Sharing

The LCM600 series main output V1 is equipped with current sharing capability. This will allow up to 10 power supplies to be connected in parallel for higher power application. Current share accuracy is typically 10% of full load. SWP Node voltage at full load is to be 5.5-6.5 Volts and 2.5-3.5 Volts at 50% of maximum current. The I^2C Line should be connected separately when the number of units in parallel is more than 8.

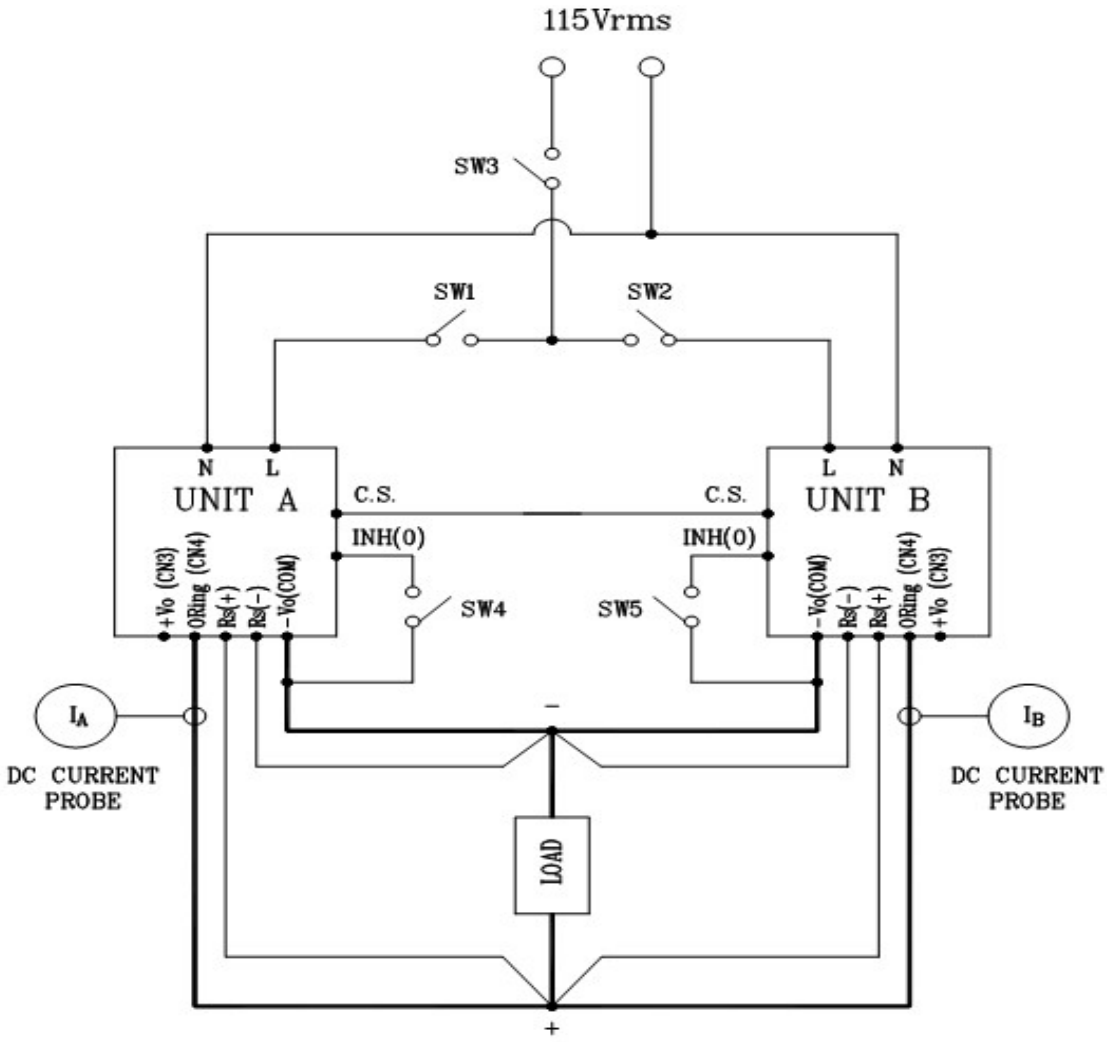
The table below shows the derated Maximum Power capacity when units are in parallel configuration. This is to consider the 10% load sharing tolerance.

Number of Units in Parallel (N)	**Maximum Output power** Rated + [(N-1) x 0.9] x Rated, Where: Rated – 600W, N – Number of Psu in Parallel
Stand-alone 600W	600W
2	1140W
3	1680W
..	..
....	….
10	5460W

The PSU will have an active load sharing percentage as shown below.

Rail Loading	**Ideal 100% share is 50%/50%**	**Example, (Total - 50A)**
100%	10%: Max 55%, Min 45% of load	50A Total (27.5A to 22.5A)
50%	10%: Max 55%, Min 45% of load	25A Total (13.75A to 11.25A)
20%	20%: Max 60%, Min 40% of load	10A Total (6A to 4A)
Below 20%	Must not draw current or suffer functional problems.	Not Specified.

Redundant Operation Connection Diagram



Note 1 Above figure shows connection for two power supply. Similar connection must below followed for higher number of power supplies connected. The maximum number of power supply is 8 power supply connection.

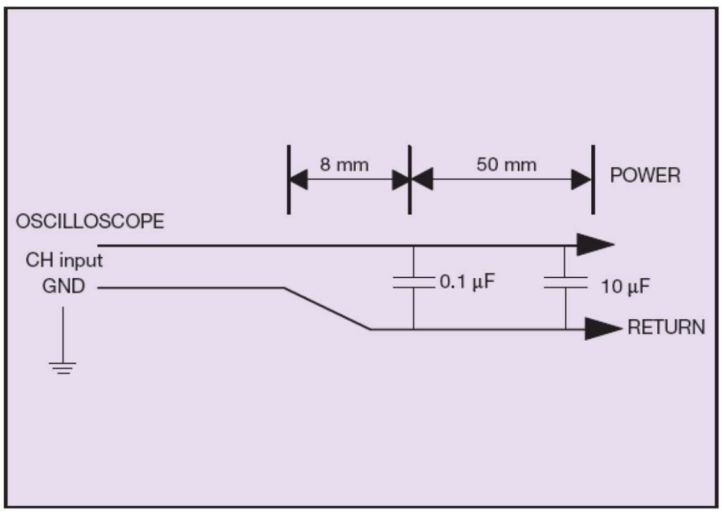
Note 2 PMbus Address should be set unique per power supply.

Note 3 The G_DCOK _C pins and G_ACOK_C pins can be connected together to the system DCOK and ACOK input pins. This can also we wired separately so the system will still continue to operate in case 1 PSU fails. The system should have a 3 separate input for ACOK and DCOK signals.

Note 4 Read I_out per power supply. The reported I-out per power supply should be the same or similar.

Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the LCM600 series. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 10 uF aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20 MHz bandwidth for this measurement.



Record of Revision and Changes

Issue	Date	Description	Originators
1.0	08.01.2012	First Issue	V. Wei
1.1	08.01.2012	Delete Global DCOK and ACOK signal SCH	V. Wei
1.2	11.07.2012	Add other product in the spec	V. Wei
1.3	09.06.2013	Update Global ACOK Circuit	V. Wei
1.4	11.04.2013	Update Command list 44h 46h WR	V. Wei
1.5	12.29.2014	Add the LCM600N	V. Wei
1.6	04.28.2015	Change the pull-up resistor of A0, A1, A2	V. Wei
1.7	01.13.2016	Updated the I^2C detail	V. Wei
1.8	05.03.2016	Update page 2 module number/ Update the remote sense description	K. Wang
1.9	06.03.2016	Update Terminal block and IEC connector	K. Wang
2.0	07.05.2016	Update IEC connector	K. Wang
2.1	11.08.2016	Update the waveform figure 34 to figure 39 for Power Good	K. Wang
2.2	01.26.2017	Delete the 90h command	K. Wang
2.3	09.12.2017	Update the operating altitude	A. Zhang
2.4	11.29.2017	Update the safety certificates	A. Zhang
2.5	03.26.2018	79H Fan fault waning is not support	K. Wang
2.6	05.05.2019	Update mating connectors / mechanical issue	K. Wang
2.7	10.25.2019	1. Add “-N” “-8” suffix note 2. OVP point	K. Wang
2.8	03.27.2020	1.Update the OCP description for L/N 2. Update dynamic 3. Add the isolation production spec	K. Wang
2.9	05.05.2020	Update leakage current specification	C. Liu
3.0	07.07.2020	1. Update Safety Certifications 2. Remove suffix “-8”	C. Yan/Kathy

WORLDWIDE OFFICES

Americas
2900 South Diablo Way
Suite B100
Tempe, AZ 85282
USA
+1 888 412 7832

Europe (UK)
Ground Floor Offices
Barberry House, 4 Harbour Buildings
Waterfront West, Brierley Hill
West Midlands, DY5 1LN, UK
+44 (0) 1384 842 211

Asia (HK)
14/F, Lu Plaza
2 Wing Yip Street
Kwun Tong, Kowloon
Hong Kong
+852 2176 3333

ARTESYN™
An Advanced Energy Company
www.artesyn.com

For more information: www.artesyn.com
For support: productsupport.ep@artesyn.com