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NUCLEUS

N500 Hardware Manual

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1 INTRODUCTION

The Nucleus N500 is an Intel® Atom based integrated gaming control board. The N500 offers the functionality of an x86 platform with dedicated gaming Input/Output (I/O). The board has been designed to operate with both Linux and Microsoft® XP Embedded operating systems.

This manual gives a detailed description of the Issue 2 hardware platform and board configuration information. If you require information that is not covered by this manual please contact Heber Technical Support (support@heber.co.uk).

2 N500 FEATURE SUMMARY

Table 1 – N500 Board Features

Dimensions	282mm x 206mm
Processor	Intel® Atom N270 single core CPU 1.6GHz (soldered directly to the board)
System Memory	1 SODIMM memory socket Single DDR2 SODIMM Memory module at 400 or 533MHz Support for up to 1GB
Chipset	Intel® 945GSE Express Chipset consisting of: 82945GSE Graphics and Memory Controller Hub (GMCH) 82801GBM I/O Controller Hub (ICH7M)
LAN	Realtek® RTL8102E 10/100 Mbit/sec Ethernet with RJ45 connector
Graphics	Integrated Intel GMA950 graphics controller Dual video output using 2 independent 15way VGA analogue display outputs Supports Windows® Extended desktop mode (Independent displays) Display memory assigned from system memory in BIOS
Audio	Realtek ALC662 High Definition Audio with 10W Stereo Amplifier for direct speaker connection. Line Level Output, Line Level Input and MIC Level Input 3.5mm Jack.
Expansion	One PCI slot One PCIe x 1 slot
Peripheral Interfaces	2 SATA interfaces 1 IDE 44way interface 1 Compact Flash Socket 1 Disc on Chip Connector - Silicon Systems (Silicondrive II). 4 USB 2.0 PS/2 mouse and keyboard ports (fitted to debug boards) 3 RS232 serial ports (9way D-types). 1 configurable RS232/RS485 serial port (9way D-type). 1 configurable RS-232 serial port or ccTalk port 1 configurable 5V TTL RS232 serial port or ccTalk port
BIOS	Custom BIOS with user configurable options Battery backed CMOS settings 4Mb (512KB) Automatic power-on ('Always on' Design)
Power	20W ATX Power input Connector 10W Front panel Power Out connector 4W Power Out Connector for Internal Hard Disk Drive 4W Power In Connector for I/O Block
Power Management	APMI 1.2 – ACPI Compliant Reset Watchdog timer – Programmable in BIOS
Inputs	16 general purpose Inputs with +5V pull ups 8 Bi-directional, 5V CMOS inputs or 250mA outputs 1 8way DIL switches (8 inputs) +12V Current sensed meter supply. 4 Power-off inputs (Intrusion / Tamper switches with Time stamp event log) PC case open input (Case tamper switch)
Outputs	20 Open drain outputs up to 250mA 4 High Current Open drain outputs up to 3A 6 5V CMOS outputs Direct support for Starpoint SEC meters
Battery Backed SRAM	512KB user SRAM device Rechargeable battery - Providing a minimum 90day hold-up time

	Battery voltage monitoring – to meet GLI-11 specification
Security	Dallas electronic serial number (DS2411) Customer specific security device with power-off monitoring of security switches, timestamp of events and board unlocking functions
Removable Non-Volatile Data Storage	Socketed 32KB I^2C EEPROM

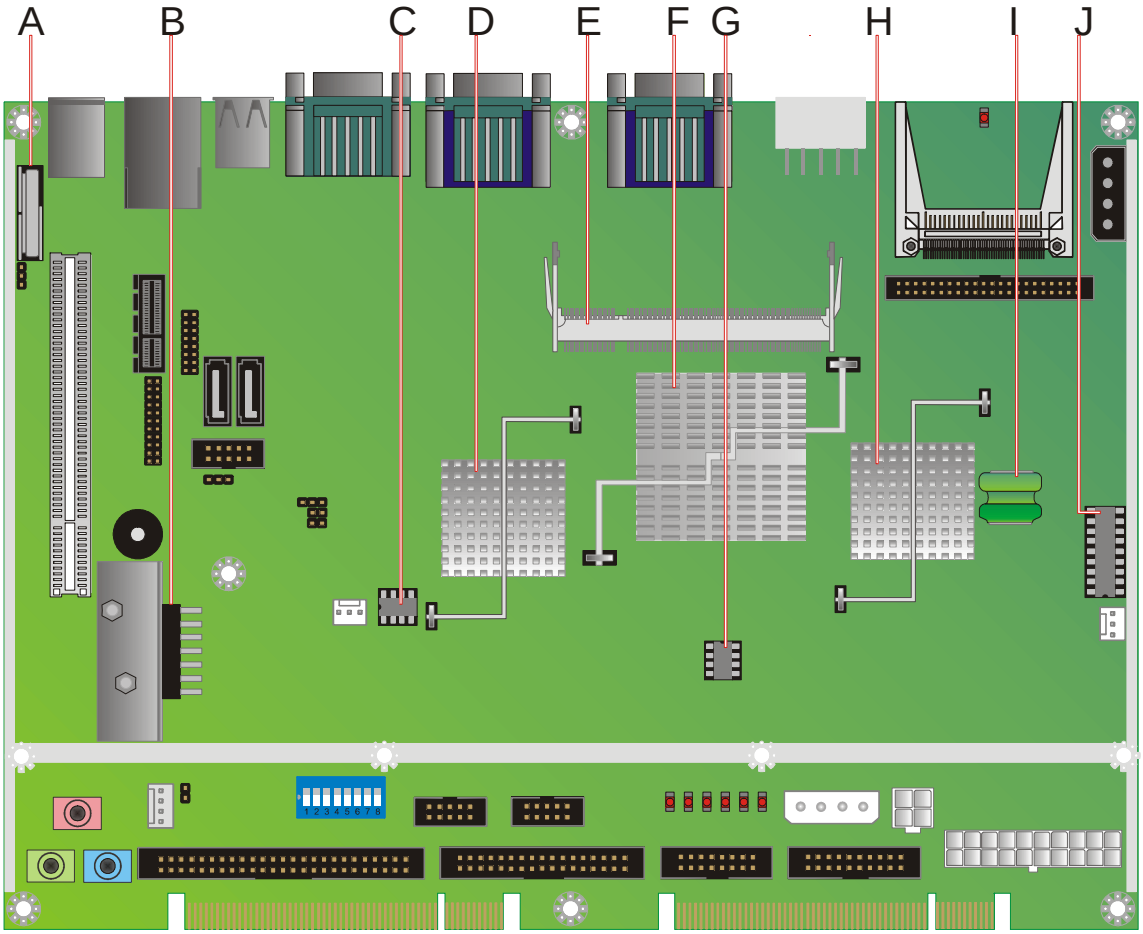
Table 2 – N500 Environmental Features

Ambient operating temperature	0-50 degrees Celsius
RoHS	Components and processes - RoHS compliant
CE compliance	CE-compliant, meeting the appropriate parts of EN61000 and EN55022
Production Life	> 5 years
Warranty	1 year
Operational Life	> 5 years continuous operation at 50 degrees Centigrade, excluding batteries
Thermal	Passive heat cooling for CPU and Chipset

3 BOARD LAYOUT

The following figure illustrates the main components on the N500 Control Board.

Figure 1 – Board Layout and Main Components



A	CMOS Battery
B	Audio Amplifier
C	BIOS
D	South Bridge
E	DDR2 SODIMM Socket
F	North Bridge
G	EEPROM
H	CPU (Intel Atom N270)
I	Standby Operation Battery
J	Customer Security Device

3.1 A - CMOS Battery

The board is fitted with a 3V CR2032 Lithium battery that provides power to the CMOS RAM where the BIOS settings are held.

3.2 B – Audio Amplifier

The Audio Amplifier provides 10Watt 8ohm stereo output through the Audio Stereo Output connector (P1).

3.3 C – BIOS

The board is fitted with 4Mb (512KB) SPI EEPROM that contains the system BIOS.

3.4 D - Intel® 82801GBM (South Bridge)

The Intel® 82801GBM is based on the ICH7 controller hub to provide the main board I/O support.

3.5 E - DDR2 SODIMM Socket

The board can be fitted with up to 1GB 400MHz or 533MHz DDR2 SODIMM DRAM.

3.6 F - Intel® 82945GSE (North Bridge)

The Intel® 82945GSE manages the flow of information between the system memory interface, the Front Side Bus, the Graphics Interface and the Direct Media Interface (DMI).

3.7 G - EEPROM

32KB I^2C EEPROM.

3.8 H - CPU (Intel® Atom N270)

The Intel® Atom N270 1.6GHz CPU main system processor.

3.9 I - Standby Operation Battery

2.4V Rechargeable Nickel Metal Hydride 70mAh battery that provides power to the security system when the board is powered down.

3.10 J - Customer Security Device

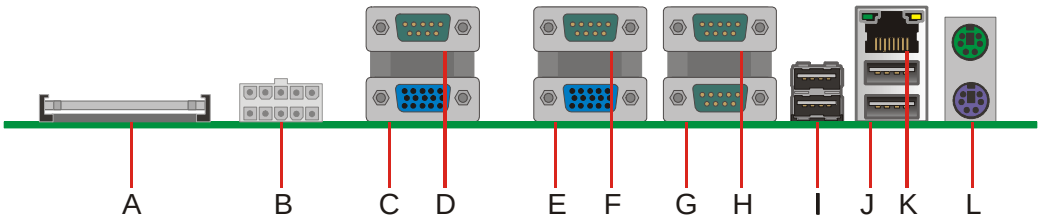
PIC16LF819 customer specific security device that provides the following:

- Monitoring of security switches when the system is powered down
- Customer configurable serial number
- Real time clock
- Battery Monitoring

4 FRONT PANEL CONNECTORS

The Front Panel Connectors are accessible on the front of the board and provide the majority of the main board peripheral interfaces.

Figure 2 – Front Panel

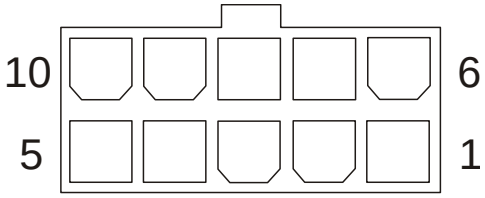


A	Compact Flash Socket
B	Power Out
C	VGA 1
D	COM1
E	VGA 2
F	COM2
G	COM3
H	COM4
I	USB (x2)
J	USB (x2)
K	Ethernet
L	PS/2 Mouse and Keyboard (Development boards only)

4.1 A- Compact Flash Socket

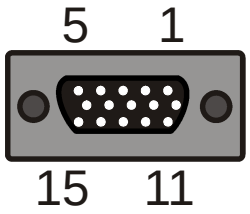
50 pin standard Compact Flash socket.

4.2 B - Power Out



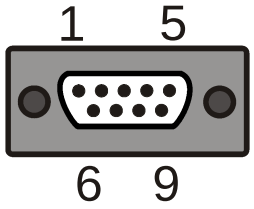
Pin	Signal	Description
1	12VIO	+12V Output
2	12VIO	+12V Output
3	12VIO	+12V Output
4	12VIO	+12V Output
5	GND	Ground 0V
6	GND	Ground 0V
7	GND	Ground 0V
8	GND	Ground 0V
9	5VIO	+5V Output
10	5VIO	+5V Output

4.3 C - VGA1



Pin	Signal	Description
1	VGA_R	Video Red Output
2	VGA_G	Video Green Output
3	VGA_B	Video Blue Output
4	NC	Not connected
5	GND	Ground 0V
6	GND	Ground Input
7	GND	Ground 0V
8	GND	Ground 0V
9	+5V	+5V Output
10	GND	Ground 0V
11	ID0	Monitor ID 0 (Not connected)
12	DDC_DATA	Display Data Channel Data
13	HSYNC	Horizontal Synchronisation
14	VSYNC	Vertical Synchronisation
15	DDC_CLK	Display Data Channel Clock

4.4 D, F, G, H - COM1, COM2, COM3, COM4

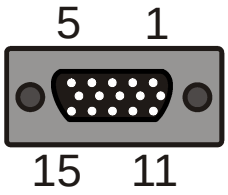


Pin	Signal	Description
1	DCD	Data Carrier Detected (If COM2 configured for RS485: 485Data-)
2	RD	Receive Data (If COM2 configured for RS485: 485Data+)
3	TD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground 0V
6	DSR	Data Set Ready
7	RTS	Request To Send (When COM2 is configured for RS485: Set RTS signal to enable RS485 transmit mode – otherwise COM2 is in RS485 receive mode).
8	CTS	Clear To Send
9	RI	Ring Indicator

Note: COM2 can be configured as RS232 or RS485 depending on the settings of the jumpers JP4.

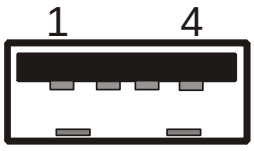
Be careful if using 'A' and 'B' signal names on RS485 interfaces. Some manufacturers define A and B the opposite way round to that of the original RS485 Specifications. Using '+' (non-inverted) and '-' (inverted) signal names is safest.

4.5 E - VGA2



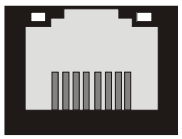
Pin	Signal	Description
1	VGA_R	Video Red Output
2	VGA_G	Video Green Output
3	VGA_B	Video Blue Output
4	NC	Not connected
5	GND	Ground 0V
6	GND	Ground 0V
7	GND	Ground 0V
8	GND	Ground 0V
9	+5V	Not connected
10	GND	Ground
11	ID0	Not connected
12	DDC_DATA	Display Data Channel Data
13	HSYNC	Horizontal Synchronisation
14	VSYNC	Vertical Synchronisation
15	DDC_CLK	Display Data Channel Clock

4.6 I and J – USB



Pin	Signal	Description
1	VCC	+5V
2	D-	Data -
3	D+	Data +
4	GND	Ground 0V

4.7 K – Ethernet



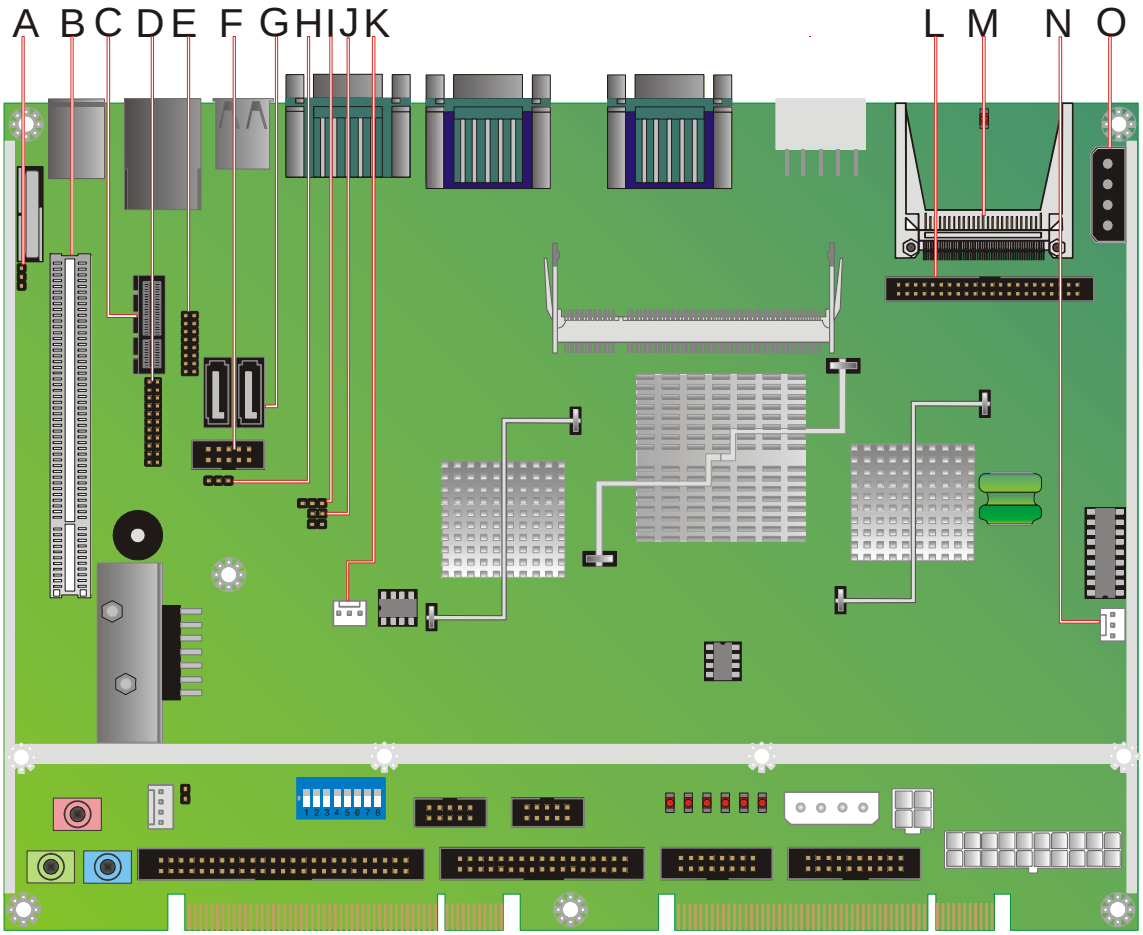
Pin	Signal	Description
1	TX +	Transmit Data +
2	TX -	Transmit Data -
3	RX +	Receive Data +
4	NC	Not Connected
5	NC	Not Connected
6	RX -	Receive Data -
7	NC	Not Connected
8	NC	Not Connected

4.8 L – PS/2 (Mouse and Keyboard)

Pin	Signal	Description
1	DATA	Data
2	NC	Not Connected
3	GND	Ground 0V
4	VCC	+5V
5	CLK	Clock
6	NC	Not Connected

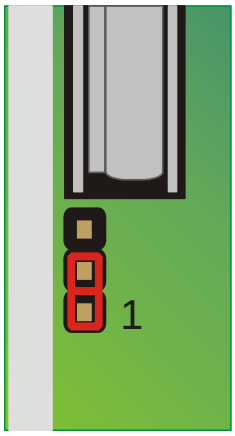
5 MAIN BOARD CONNECTORS AND JUMPERS

Figure 3 - Main Board Connectors and Jumpers



A	JP1 CMOS Clear Jumper
B	Legacy PCI Connector
C	PCIe x 1
D	COM2 Serial Selection Jumpers
E	Front Panel Connectors
F	USB DOM Header
G	SATA 1 and SATA 2
H	SATA Power Jumper
I	Case Intrusion Connector
J	Auto power on link
K	System Fan (2)
L	44 way IDE header
M	Compact Flash Socket
N	CPU Fan (1)
O	Hard Disk Power Out

5.1 A - CMOS Clear Jumper



5.1.1 Normal Operation

Under normal operation pins 1 and 2 are connected.

5.1.2 Clear RTC/CMOS

To clear the RTC/CMOS connect pins 2 and 3.

5.2 B – Legacy PCI Connector

Legacy 32bit PCI expansion connector.

5.3 C – PCIe x 1

PCI Express x 1 expansion connector.

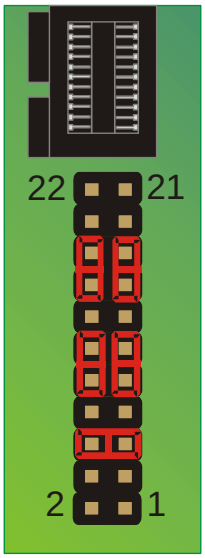
5.4 D – COM2 Serial Selection Jumpers

COM2 can be configured as one of the following serial options using the jumpers on header JP4:

- RS232
- RS485

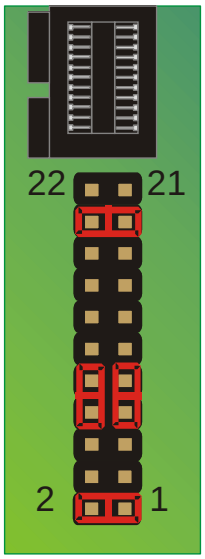
The following sections show the appropriate jumper settings for each mode of operation.

5.4.1 RS232 Jumper Setting



- Pins 5-6 closed
- Pins 9-11 closed
- Pins 10-12 closed
- Pins 15-17 closed
- Pins 16-18 closed

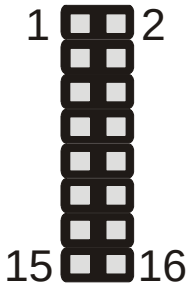
5.4.2 RS485 Jumper Setting



- Pins 1-2 closed
- Pins 7-9 closed
- Pins 8-10 closed
- Pins 19-20 closed

See also “RS485 Termination” topic in Section 6 of this manual.

5.5 E – Front Panel Connectors



Pin	Signal	Description
1	5VSB	+5V Standby
2	NC	Not Connected
3	NC	Not Connected
4	NC	Not Connected
5	SUSLED	Suspend LED (cathode)
6	NC	Not Connected
7	NC	Not Connected
8	NC	Not Connected
9	NC	Not Connected
10	5VSB	+5V Standby
11	NC	Not Connected
12	POWER_SW	Power Switch
13	HD_LED	Hard Disk LED (anode)
14	SYSRST	System Reset (active low)
15	HD_LED	Hard Disk LED (cathode)
16	GND	Ground

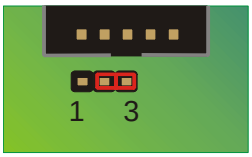
5.6 F– USB DOC Header

USB Disk-On-Chip connector for Silicon Systems (Silicondrive II).

5.7 G – SATA 1, SATA 2

2 connectors for serial ATA devices.

5.8 H – SATA Power Jumper



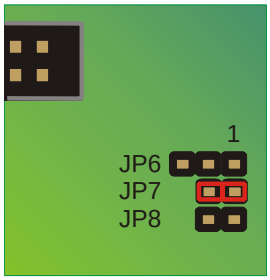
Pins 1 and 2 closed – power to the SATA connector
Pins 2 and 3 closed (default) – no power to the SATA connector

The SATA Power Jumper allows SATA Disk on Modules (DOMs) that can be powered through the SATA connector to be used. This only powers the right hand connector (J12).

5.9 I – Case Intrusion Connector

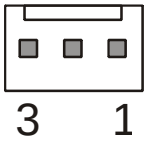
Pin	Signal	Description
1	CASEOPEN	Case Open Signal
2	GND	Ground 0V
3	POFF_SW3	PIC Security Switch 3

5.10 J - Auto Power On Link



Jumper JP7 closed – default setting
Jumper JP8 – reserved.

5.11 K, N - Fan1, Fan2



Pin	Signal	Description
1	GND	Ground 0V
2	+12V	+12 Power
3	FAN_IO	Fan Speed Pulse Output

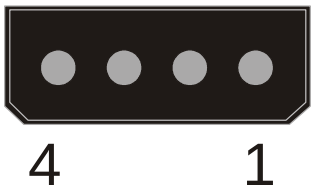
5.12 L – 44w IDE Header

44 way IDE connector for parallel ATA drives.

5.13 M – Compact Flash Connector

50 pin connector for IDE Compact Flash cards.

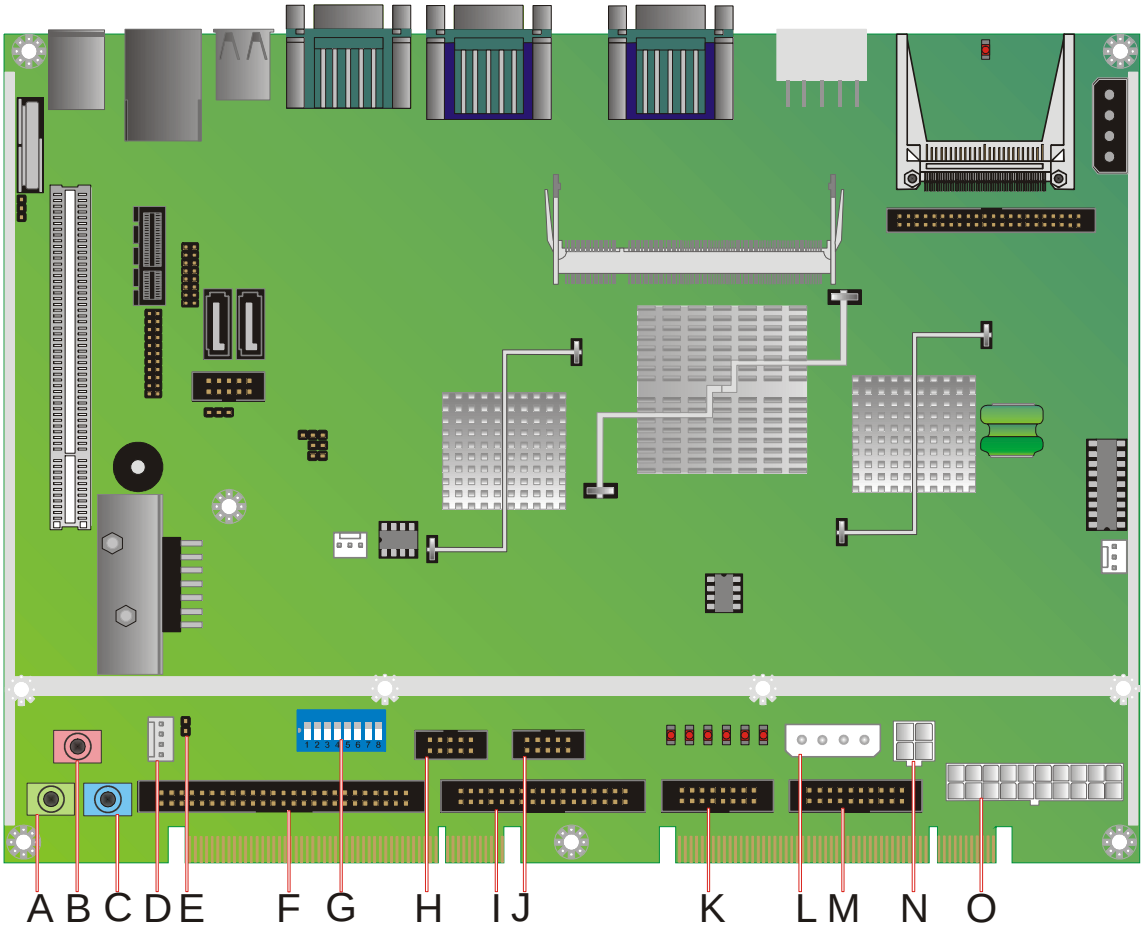
5.14 O – Hard Disk Power Out



Pin	Signal	Description
1	+12V	+12V Output
2	GND	Ground 0V
3	GND	Ground 0V
4	VCC	+5V Output

6 IO BLOCK CONNECTORS

Figure 4 – I/O Block Connectors



A	Audio (line) Out
B	Mic
C	Audio (line) In
D	Audio Stereo Loudpseakers
E	RS485 Termination
F	I/O 2
G	DIL Switch (x 8)
H	CCTalk Channel A
I	I/O 1
J	CCTalk Channel B
K	I/O 3
L	I/O Power In
M	CCTalk Channels A and B
N	Power In
O	ATX Power In

6.1 A – Audio Out

Line Level Output audio connection – 3.5mm Stereo Jack.

6.2 B – MIC

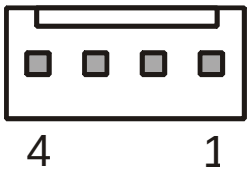
MIC Level Input audio connection – 3.5mm Stereo Jack.

6.3 C – Audio In

Line Level Input audio connection – 3.5mm Stereo Jack.

6.4 D – Audio Stereo Loudspeakers

10 Watt Amplified stereo audio output (8 ohms).



Pin	Signal	Description
1	LS/R+	Loud Speaker Right Positive
2	LS/R-	Loud Speaker Right Negative
3	LS/L+	Loud Speaker Left Positive
4	LS/L-	Loud Speaker Left Negative

6.5 E – RS485 Termination

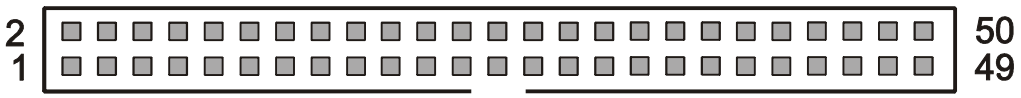
If COM2 is used for RS232 the pins should be left open.

If COM2 is used for RS485, and line termination is required (typically only the two devices at the extreme ends of the RS485 network cable), these pins should be closed with a jumper.

The terminator is a 150 ohm resistor that connects between 485Data+ and 485Data- signal lines when the jumper is inserted. An RS485 biasing network is also provided: a 1.2k resistor from the 485Data+ line to Vcc and a 1.2k resistor from the 485Data- line to ground. The bias network ensures that the RS485 data lines are held in the “idle” state while all devices are in receive mode.

Other COM2 jumper settings required for RS485 communication are listed in Section 5 of this document.

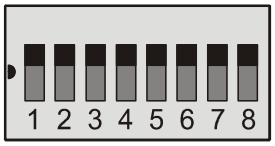
6.6 F – I/O Connector 2



Pin	Signal	Description
1	OP16	Open Drain Output 16
2	OP17	Open Drain Output 17
3	OP18	Open Drain Output 18
4	OP19	Open Drain Output 19
5	OP20	Open Drain Output 20
6	OP21	Open Drain Output 21
7	OP22	Open Drain Output 22
8	OP23	Open Drain Output 23
9	OP24	Open Drain Output 24
10	OP25	Open Drain Output 25
11	OP26	Open Drain Output 26
12	OP27	Open Drain Output 27
13	OP28	High Current Output 28 *
14	OP28	High Current Output 28 *
15	OP29	High Current Output 29 *
16	OP28	High Current Output 28 *
17	OP29	High Current Output 29 *
18	OP29	High Current Output 29 *
19	OP30	High Current Output 30 *
20	OP30	High Current Output 30 *
21	OP31	High Current Output 31 *
22	OP30	High Current Output 30 *
23	OP31	High Current Output 31 *
24	OP31	High Current Output 31 *
25	IP6	Input 6
26	IP7	Input 7
27	IP8	Input 8
28	IP9	Input 9
29	IP10	Input 10
30	IP11	Input 11
31	IP12	Input 12
32	IP13	Input 13
33	IP14	Input 14
34	IP15	Input 15
35	12VIO	+12v Output
36	12VIO	+12v Output
37	12VIO	+12v Output
38	12VIO	+12v Output
39	GND	Ground 0V
40	GND	Ground 0V
41	GND	Ground 0V
42	GND	Ground 0V
43	GND	Ground 0V
44	GND	Ground 0V
45	POFF_COM	Security Switch Common
46	GND	Ground 0V
47	POFF_SW0	Security Switch 1
48	POFF_SW1	Security Switch 2
49	POFF_SW2	Security Switch 3
50	POFF_SW3	Security Switch 4

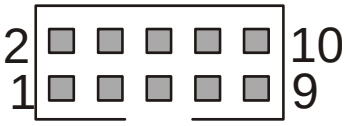
***** Duplicated outputs can be used in parallel where a current capacity greater than 1Amp is required.

6.7 G – DIL Switch



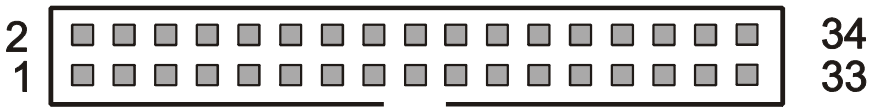
Software readable 8way DIL switch.

6.8 H – CCtalk Channel A



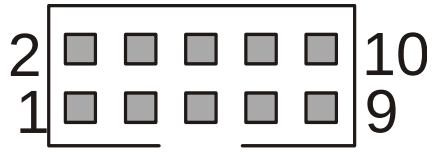
Pin	Signal	Description
1	CCA_DATA	CCtalk Channel A data
2	GND	Ground 0V
3	CCA_BUSY	CCtalk Channel A busy
4	GND	Ground 0V
5	OP8	CCtalk Channel A Reset (Output 8)
6	N/C	Not Connected
7	12VIO	+12V
8	GND	Ground 0V
9	GND	Ground 0V
10	12VIO	+12V

6.9 I – I/O Connector 1



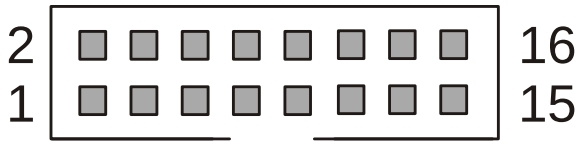
Pin	Signal	Description
1	OP0/IP16	Open Drain Output 0/Input 16
2	OP1/IP17	Open Drain Output 1/Input 17
3	OP2/IP18	Open Drain Output 2/Input 18
4	OP3/IP19	Open Drain Output 3/Input 19
5	OP4/IP20	Open Drain Output 4/Input 20
6	OP5/IP21	Open Drain Output 5/Input 21
7	OP6/IP22	Open Drain Output 6/Input 22
8	OP7/IP23	Open Drain Output 7/Input 23
9	OP8	Open Drain Output 8
10	OP9	Open Drain Output 9
11	OP10	Open Drain Output 10
12	OP11	Open Drain Output 11
13	OP12	Open Drain Output 12
14	OP13	Open Drain Output 13
15	OP14	Open Drain Output 14
16	OP15	Open Drain Output 15
17	IP0	Input 0
18	IP1	Input 1
19	IP2	Input 2
20	IP3	Input 3
21	IP4	Input 4
22	IP5	Input 5
23	V_METER	+12v Sensed Current
24	12VIO	+12v
25	GND	Ground 0V
26	GND	Ground 0V
27	LS/L+	Input 8
28	LS/R+	Input 9
29	LS/L-	Input 10
30	LS/R-	Input 11
31	GND	Ground 0V
32	GND	Ground 0V
33	NC	Not Connected
34	NC	Not Connected

6.10 J – CCtalk Channel B



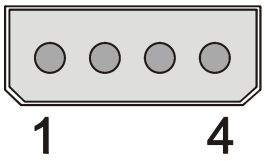
Pin	Signal	Description
1	CCB_DATA	CCtalk Channel B data
2	GND	Ground 0V
3	CCB_BUSY	CCtalk Channel B busy
4	GND	Ground 0V
5	OP9	CCtalk Channel B Reset (Output 9)
6	N/C	Not Connected
7	12VIO	+12V
8	GND	Ground 0V
9	GND	Ground 0V
10	12VIO	+12V

6.11 K – I/O 3



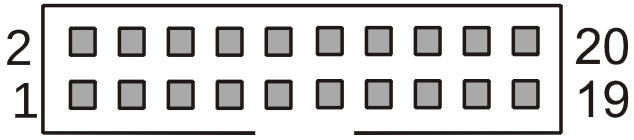
Pin	Signal	Description
1	GND	Ground 0V
2	GND	Ground 0V
3	RS232A_RX	RS232 channel A receive
4	RS232A_TX	RS232 channel A transmit
5	RS232A_CTS	RS232 channel A clear to send
6	RS232A_RTS	RS232 channel A ready to send
7	TTL_RX	TTL level receive
8	TTL_TX	TTL level transmit
9	12VIO	+12 volt output
10	-12v	-12 volt output
11	AUX0	Auxiliary output 0
12	AUX1	Auxiliary output 1
13	AUX2	Auxiliary output 2
14	AUX3	Auxiliary output 3
15	AUX4	Auxiliary output 4
16	AUX5	Auxiliary output 5

6.12 L – I/O Power In



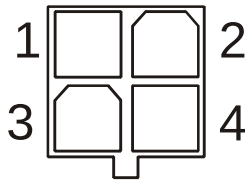
Pin	Signal	Description
1	12VIO	+12V Input
2	GND	Ground 0V
3	GND	Ground 0V
4	5VIO	+5V Input

6.13 M –CCTalk Channels A and B



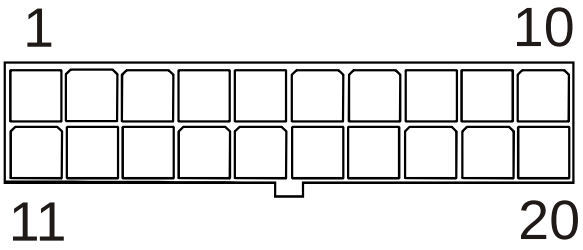
Pin	Signal	Description
1	CCA_DATA	CCtalk Channel A data
2	GND	Ground 0V
3	CCA_BUSY	CCtalk Channel A busy
4	GND	Ground 0V
5	OP8	CCtalk Channel A Reset (Output 8)
6	N/C	Not Connected
7	12VIO	+12V
8	GND	Ground 0V
9	GND	Ground 0V
10	12VIO	+12V
11	CCB_DATA	CCtalk Channel B data
12	GND	Ground 0V
13	CCB_BUSY	CCtalk Channel B busy
14	GND	Ground 0V
15	OP9	CCtalk Channel B Reset (Output 9)
16	N/C	Not Connected
17	12VIO	+12V
18	GND	Ground 0V
19	GND	Ground 0V
20	12VIO	+12V

6.14 N – 12V Power In



Pin	Signal	Description
1	GND	Ground 0V
2	GND	Ground 0V
3	12V	+12V Input
4	12V	+12V Input

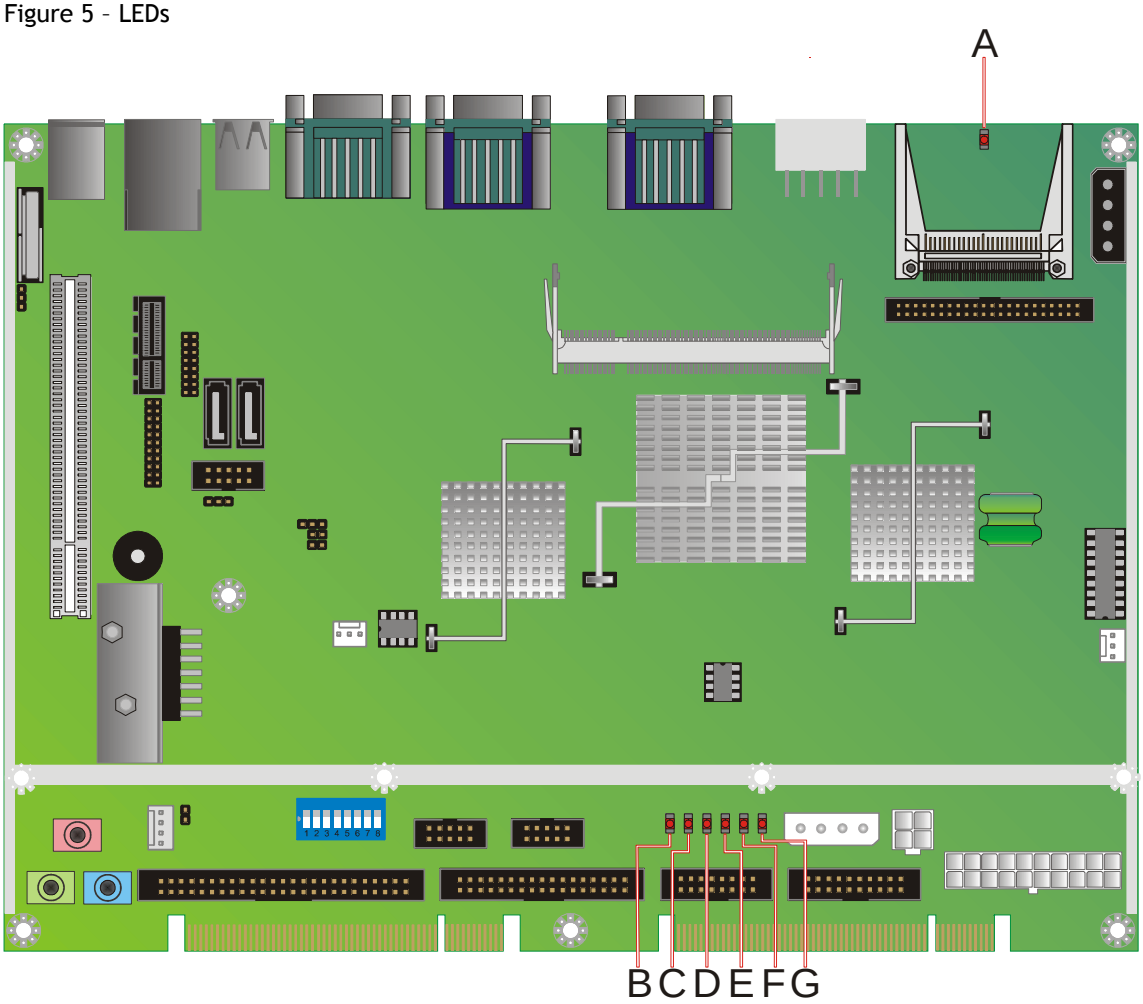
6.15 O – ATX Power In



Pin	Signal	Description
1	VCC3	+3.3V
2	VCC3	+3.3V
3	GND	Ground 0V
4	VCC	+5V
5	GND	Ground 0V
6	VCC	+5V
7	GND	Ground 0V
8	PW_OK	Power Good Signal
9	5VSB	+5V Standby
10	+12V	+12V
11	VCC3	+3.3V
12	-12V	-12V
13	GND	Ground
14	PS_ON	Power Supply On
15	GND	Ground 0V
16	GND	Ground 0V
17	GND	Ground 0V
18	-5V	-5V
19	VCC	+5V
20	VCC	+5V

7 BOARD LEDS

Figure 5 – LEDs



A	Hard Disk Activity
B	I/O Processor Active
C	+5V IO Block Power Indicator
D	+12V IO Block Power Indicator
E	+3V Main Board Power Indicator
F	+5V Main Board Power Indicator
G	+12V Main Board Power Indicator

8 BIOS UPDATES

BIOS updates will be posted on the Heber Web site for download along with programming instructions.