AGPROIX / AGPIX32
AGP-PRO / AGP
Bus Isolation Extender

User's Manual
Rev C / E

AGPROIX / AGPIX32 User's Manual

PREFACE

The AGPROIX and AGPIX32 are bus isolation extenders for the Accelerated Graphics Port (AGP) and – PRO (AGP-PRO) buses. The only difference between them, is the connector on top. It allows AGP or AGP-PRO adapter boards to be added or removed from the AGP system bus, without having to power down the system. It offers time and labor cost savings in product development and production board testing. It also serves to protect the motherboard from being damaged during testing.

Operation of the AGPROIX / AGP extender can be controlled by an on-board toggle switch or by external TTL input signal. The user is required to provide re-initialization routines to restore the state of the board under test, during successive testing.

This manual serves for both the AGPIX32 and the AGPROIX extenders. For simplicity of the manual, the name AGPROIX is used for the rest of the context in this manual.

Related Products:

AGPROSX4	AGP-PRO wearout extender.
AGPPRO-01,11	AGP-PRO straight riser.
AGPTPROTX	AGP-PRO right angle riser.
PCIAGPTX01	PCI/AGP-PRO/PCI combo riser.
AGPSX4	AGP wearout extender.
AGPRX4	AGP right angle riser.
AGPEX4	AGP regular extender.
AGPFLEX	AGP flexible extender.
PAPTX-AGP	PCI/AGP/AGP combo riser.

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AGP-PRO is a trademark of Intel Corp.
All other products mentioned in this manual are trademarks of their respective manufacturers.

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Product Specifications:

Bus:	AGP-PRO (Accelerated Graphics Port - PRO) bus.
Power:	+5V with one 1.6 amp pluggable fuse. +3.3V with two 4 amp pluggable fuses. +12V with two 4 amp pluggable fuses. +VDD with one 1.6 amp pluggable fuse. Plus short circuit sensing logic on all power lines.
Control:	Single toggle switch or external TTL control.
Signal Delay:	Less than 500 picosecond (250 picosecond max. through the buffer).
Environment:	0-60 degree C (operating and storage).
Dimension:	Length 8.8 inches; Height 1.95 inches; Width 0.6 inches (Not including the mounting bracket).

Product Features:

- Total power and signal isolation.
- No disturbance to the system bus during bus isolation and reconnection.
- Less than 500ps signal delay (isolation buffer + trace delay).
- Minimum voltage drop through power isolation logic.
- Single switch operation or external TTL control signals.
- Allows external voltage margin and current measurement.
- Pluggable fuses on all power lines allowing easy replacement and change to other types and values of fuses.
- Power status LEDs for clear indication of power isolation.
- Short circuit sensing with auto power shut off.
- Reset pulse generation during power on.
- Flashing operating red status LED.
- Multi-tone adjustable volume speaker for normal and short circuit condition.
- Supports low cost wearout extender (AGPROSX4 / AGPSX4).
- Quality multilayer construction.
- Supports AGP1X, 2X, 4X and 8X mode.

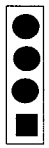
AGPROIX OPERATING INSTRUCTIONS

1. Insert the extender into an AGP-PRO expansion slot, on an AGP-PRO motherboard. Secure the extender to the system enclosure with mounting bracket.
2. Power up the system, SW1 switch should initially be in up position. After a few seconds, the green power LEDs should be lit, the red LED should blink about once every second and the buzzer should sound about once a second (if enabled).
3. Test the extender by switching the SW1 switch up and down. The red LED should be flashing with SW1 in up position and the AGP-PRO BUS active. The speaker should also buzz about once per second to indicate bus connection. Adjust the volume of the speaker, via the trim pot by the speaker or disable it by removing the jumper at W11.
4. **Add or remove** add-on boards to the extender only when the SW1 switch is in the **down position**, the LED is not flashing and the speaker is not buzzing (bus isolated). **Warning!** For AGP card without the **registration tab**, a slight **misalignment** exists, and it will damage the system severely, if inserted into the AGP-PRO connector. A **PRO2AGPX** adapter should be used to resolve this problem.

5. Run test to the add-on boards with SW1 switch in the up position.
6. To make current measurements without the fuse, remove the corresponding plug fuse and place an ampere meter across pin 1 and pin 3 of the fuse socket pins. To make measurement with the fuse, insert fuse at pin 2 and pin 4 of the socket pins, and connect the ampere meter across pin 1 and pin 4 of the fuse socket pins.
7. To make voltage margin test, connect external voltage and ground to corresponding pins of the terminal blocks W8, W9 or W12 and move the corresponding plug fuse to pin 2 -4 position. **Warning! Pin 1 of the fuse sockets should not be connected to external power in any way. This is due to being tied directly to the system power.**
8. To remove the adapter boards from the extender, one should be careful not to lift the extender out of its system expansion slot. Keep the extender down while removing the adapter board and make sure the extender is **turned off**.

FUSE and PIN HEADER DEFINITION

Fuse Socket



W2 +5V with 1.6 amp plug fuse.
W3,W6 +12V with 4 amp plug fuses.
W4,W7 +3.3V with 4 amp plug fuses.
W5 +VDD with 1.6 amp plug fuse.

W10, Speaker Jumper

Jumper in - Speaker will buzz at approximately once per second during normal operation, while bus signals and powers are fully connected. The volume is adjustable by the trim pot at RP1.

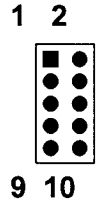
Jumper out - Speaker will not buzz during normal operation, but will still generate a continuous tone, at the loudest volume (not adjustable) if logic detects a short circuit condition.

Short-circuit Sensing Jumper

Jumper in – Enables the Short Circuit sensing logic
Jumper out – Disables the Short Circuit sensing logic.

LVDD, LV12, LV3, LV5 for VDD, +12V, +3.3V and +5V voltages respectively.

W1 Pin Headers



1	#Power_Control (Internal)
2	+5V
3	#Signal_Control (External Input, Low enable)
4	Key
5	#Power_Control (External Input, Low enable)
6	Gnd
7	Gnd
8	Power_Control (External Input, High enable)
9	LED-
10	LED+

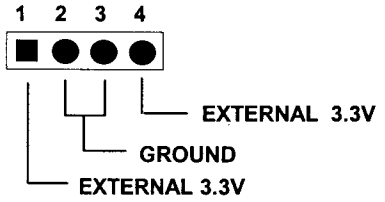
 # indicates low active input.

Pin 1 and pin 3 are jumped together in default to allow single toggle switch operation, when both power and bus signals are turned on together. The user may connect an external toggle switch or an external TTL low signal to pin 5, or an external TTL high signal to pin 8 to control the board.

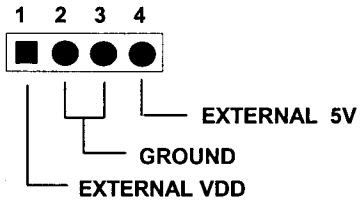
To control the bus signals separately from the bus power, remove the jumper at pin 1 and pin 3. Connect external TTL signal to pin 5 or 8 to control the power and pin 3 to control the signal. Power should be connected first, then the bus signals.

The on-board toggle switch should be at down (off) position, if external TTL controls are used.

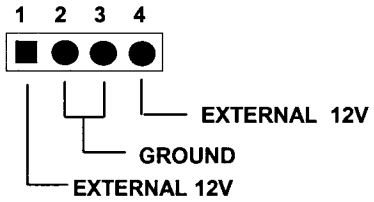
W8 External Power Terminal Block



W9 External Power Terminal Block



W12 External Power Terminal Block



External power may be supplied to the AGPROIX through the terminal blocks for voltage margin purpose. The user must move the corresponding pluggable fuses from position 1-3 to 2-4.

THEORY OF OPERATION

The Bus Isolation Extender provides bus signals and power isolation between the system motherboard and the add-on board, on the extender. The signals are isolated using state of the art analog switches that allow bi-directional signal flow. When the analog switches are turned off, the bus signals at the extender side are isolated from the system bus. When the analog switches are turned on, the bus signals are connected. The analog switch provides no signal "buffering". This means, the bus signals are not reconditioned at TTL levels, nor are they re-driven by any active amplifier. Any AC/DC signal loading on the add-on board will have a direct effect on the signal lines on the system motherboard. The analog switch introduces less than 250 picoseconds delay to the signals. Such minimal delay makes the analog switch suitable for very fast bus operation.

The power isolation is implemented using MOSFETs. The MOSFETs are biased to allow slow ramping up of current through the Bus Isolation Extender to the add-on boards, without causing a power surge or glitch to the system power. When the voltage of the power lines on the add-on board reaches about 90% of the rated voltage, the logic on the extender will turn on the analog switches to connect the bus signals. When the Bus Isolation Extender is switched off, the logic on the extender board will disconnect the bus signals immediately, thus shutting down the power slowly.

In addition, a reset pulse is generated to the add-on board, on top of the extender. This happens whenever the extender is switched on. The duration of the RESET pulse is adjustable via a RC constant. If the system issues a reset pulse while the bus is connected, the extender will pass that reset pulse to the add-on board, without disconnection or reconnection.

An on-board red status LED will blink about twice a second, when the power and the signals are completely connected between the add-on board and the system bus. The red LED will stay off, if the Bus Isolation Extender is turned off or if any of the +5, +3.3, VDD or +12 volt does not reach operating voltage within 24ms after power up.

During the operation, if a short circuit condition is developed between +5, +3.3, VDD or +12V to ground, the logic will shut off the power and the red LED. The speaker will buzz in a continuous tone to alert the operator. The user needs to switch the extender off, to reset the short circuit logic.

The add-on boards should be inserted or removed from the extender only when the extender is switched off and the red LED is not blinking and the speaker is not buzzing. ***Serious damages to the system, extender and the add-on board could happen if the add-on board is inserted or removed when the bus is still connected.***

LOCAL and EXTERNAL CONTROL

The Bus Isolation Extender has an unique external control feature. This feature is very useful in the production environment and it can be easily implemented in many ways. It allows external toggle switch or TTL logic inputs to control the operation of the extender. When used with proper software, this feature helps to automate the test process, without requiring manual switching by the operator. This external control feature is accessible through the W1 header located by the on-board toggle switch. The header is keyed for ribbon type connector interface. The 2X5 header has the pins defined on page 7, under W1 Pin headers.

ON-BOARD TOGGLE SWITCH OPERATION

This is the default operation mode as configured by the factory. This configuration allows single toggle switch operation without any external connection. A jumper is installed between pin 1 and pin 3 of the W1 header. It requires an operator to manually toggle the switch up for bus connection and toggle it down for bus isolation. When the switch is toggled up, both the power and the signals are connected by the on-board logic.

EXTERNAL TOGGLE SWITCH OPERATION

An external toggle switch can be connected between pin 5 and pin 6 of the W1 header to simulate the on-board toggle switch. In this configuration, the on-board toggle switch should be turned off (down position), and the jumper remains in pin 1 and pin 3 of W1 header. The external switch can be mounted anywhere outside the chassis, for easier access. An external LED can also be connected through pin 9 and pin 10 of the W1 header, so it can provide a status outside the chassis. The on-board LED and the toggle switch do not need to be removed in this mode of operation.

EXTERNAL LOGIC CONTROL OPERATION

The Bus Isolation Extender can also be controlled by external TTL compatible signals. If the jumper remains on pin 1 and pin 3 of W1 header, a single TTL low control line connecting to pin 5, or a TTL high signal to pin 8 of W1 header, can control both the power and signal isolation and connection, as the toggle switch. If the jumper on pin 1 and pin 3 of W1 header is removed, two TTL control lines can be used to control the bus signals and the power separately. The TTL control line that connects to pin 5 or pin 8 will control the power and the TTL control line that connects to pin 3 will control the signal. The TTL control lines can come from any digital output source, such as the output pins of the parallel printer port, in the CPU system. If the external TTL control lines are from sources outside the same CPU system, the ground pins on pin 6 or pin 7 of the W1 header should be connected to the signal ground, of the external sources. The power should be connected first, then followed by the bus signals.

Notice that pin 5 allows a TTL low signal to power up the extender, while pin 8 allows a TTL high signal to power up the extender. For systems that requires the extender to be powered up from cold start, the user can choose from available sources of either initial high or initial low signals to bring the extender up.

VOLTAGE MARGIN, CURRENT MEASUREMENT AND EXTERNAL POWER SOURCE

The AGPROIX Bus Isolation Extender is provided with pluggable slow blow fuses. One 4.0 amp fuse is used for the +3.3V and one 1.6 amp fuse is used for each of the +12V, +5V and VDD. The user can perform voltage margin to adapter boards, on top of the extender, by connecting external power to location W8, W9 and W12 (see pin definition on page 6) and by moving the pluggable fuses from position 1-3 to 2-4 location (see pin definition on page 6). When external powers are applied through the fuses, the current are still controlled by the MOSFETs, which regulate the ramping of the voltage. All on-board logic uses the power from the motherboard and is not affected by the external power.

A minimum of +4.5V on the +5V power line is required to maintain the operation. Otherwise, the logic on the extender will shut down the analog switches and isolate the bus signals. A short circuit sensing logic is also built-in to protect the system. The short circuit logic will sense shorts on +5V, +3.3V, VDD and +12V and will automatically shut off all power. The shorts can be either introduced accidentally during test or may already exist on the board under test. In short circuit condition, the speaker will generate a continuous tone to alert the user. In normal condition, the speaker will buzz once a second to alert the user that the Bus Isolation Extender is powered up.

An ampere meter can be connected between the fuse socket pins with or without the fuse to measure the current consumed by the add-on board, on top of the extender. The leads of the ampere meter should be as short as possible, to avoid excessive voltage drop below 90% of the rated voltage.

The user may change the fuses to other types, as long as the voltage drops do not fall below 90%, when the add-on board draws maximum current.

TROUBLESHOOTING AND SELF SERVICE

It is possible the Bus Isolation Extender could be damaged during operation. Our experience has shown, two of the most common problems associated with the Bus Isolation Extenders are blown fuses and blown buffer ICs. Such failures are usually caused by:

1. Users accidentally pull the add-on board out while the bus is still connected. This happens especially when the user is not yet use to the procedure, and occasionally forgets to switch the extender off, while removing the add-on board. One must observe the red LED to make sure it is not blinking or listen to the speaker, before adding or removing the add-on board. This action will cause the fuses and the buffer ICs to blow. Most commonly damaged are the one that have signals next to the power pins. This is mainly due to the add-on board being removed at an angle, which will short the power pins to the signal pins nearby.

2. The extender is lifted or wiggled side to side, while the add-on board is being removed or added. This happens if the extender is not tied down firmly. It is very important for the user to find an appropriate way to hold down the extenders, using brackets or fixtures in an open or closed chassis environment. Since the Bus Isolation Extender is still connected to the system bus, this will cause sparking in both power and signal pins that will most likely damage the buffer ICs.

3. Shorted power to signal pins or signal to signal pins on the add-on board. This condition will usually cause an overload to the buffer IC and damage it. ***Do not test the failed add-on board on the Bus Isolation Extender again until the cause is corrected.***

4. Extender connector pins or keyways are damaged due to wearout or rough handling. We strongly recommend the use of Bus Wearout Extenders such as the AGPROSX4, especially in the production environment.

We would recommend the following steps for user self troubleshooting and field testing, before returning the extender for factory service.

1. Check the extender connector pins for any physical damage, and correct them if possible.

2. Check the fuses for continuity and replace them if needed.

3. Check for all power from the motherboard to ground short, and all isolated power to ground short.

4. Visually inspect the buffer ICs for physical cracks, burn marks, etc. When the buffer IC is damaged, it will usually smoke while the bus is being connected. The damage could be caused by sparking or ESD from previous operation. Replace the damaged buffer ICs and try again.

5. Check buffer ICs by looking at the buffer pins with or without the add-on board and turn on the extender. The IC has pin 1 and 10 grounded, pin 20 connected to VCC and pin 19 as control (low for connect). Pin 2-9 and pin 18-11 are the corresponding buffer pairs. Test the pins using a logic probe. The probe should indicate the same condition; H, L or blinking on both pins of the buffer pair. Replace the buffer IC, if the condition is not the same.

6. Browse our web pages, under the Service section for detailed service and component update information.

Our experience indicates the buffer ICs at the four corners are most likely to be damaged under operation. Adex Electronics will assist customers, over the phone to locate the damaged components and recommend further action. Adex Electronics can also provide the components, as **spare parts** to the customers. Each bus isolation extender is provided with a bag of spare parts, consisting of 2 fuses, of each type and 2 buffer ICs.

BOARD INITIALIZATION

The Bus Isolation Extender isolates power and bus signals between the add-on board and the motherboard. Each time the toggle switch is turned off, the power to the add-on board is lost. Therefore, the information in the registers and memory on the add-on board will also be lost. For the next add-on board to be tested again, the add-on board will need to be reinitialized, after the power is reconnected. The user will need to develop an initialization routine to restore the information back to the add-on board, before running a new test. This can be done in a batch file where the initialization routine is placed before the test routine. The initialization routine can search for a previous saved configuration file and uses it to reinitialize the add-on board. The test software should display the test results and messages, which will tell the operator when to remove the board, add a new board for test, and how to restart the test. A **sample of the re-initialization program** is available on our web page under the Software section of the Product Summary page.

Every time the Bus Isolation Extender is powered up or down, the on-board logic will resynchronize itself to disconnect or reconnect properly. A reset signal will also be generated to the add-on board, under test during reconnection. In automated systems, the initialization software should wait approximately **30 ms** or longer (depending on the duration of the RESET pulse), after the extender is turned on, before attempting to reinitialize the board. In manual toggle switch operation, the user should wait until the red LED is blinking before reinitialization. In software controlled operation, the LED- signal could be sensed externally, at logic low state at least twice contiguously by the software. This will confirm the bus is reconnected, before reinitialization. During disconnect, the user should wait for the red LED to stop blinking, before removing the add-on board under test. In software controlled operation, the LED- should be sensed high at least twice contiguously, before putting out messages to remove the board.

MOUNTING OF BUS ISOLATION EXTENDER

The Bus Isolation Extender incorporates very fast CMOS buffers for isolation of bus signals, between the add-on board and the motherboard. These CMOS buffers are extremely sensitive to voltage spikes and can be easily damaged by Electrostatic Discharge (ESD) or any sparking due to intermittent contacts. It is necessary for users in the production environment to mount the Bus Isolation Extender firmly against a common platform, where the motherboard is mounted. For in chassis testing, a fixture or a bracket should be developed to hold the Bus Isolation Extender to the chassis. For out of chassis environment, the user should tie the motherboard and the Bus Isolation Extender down, against a common platform. Whatever fixture or bracket design is used, one should not allow the Bus Isolation Extender to be lifted, with the add-on board, nor to wiggle from side to side.

Appendix

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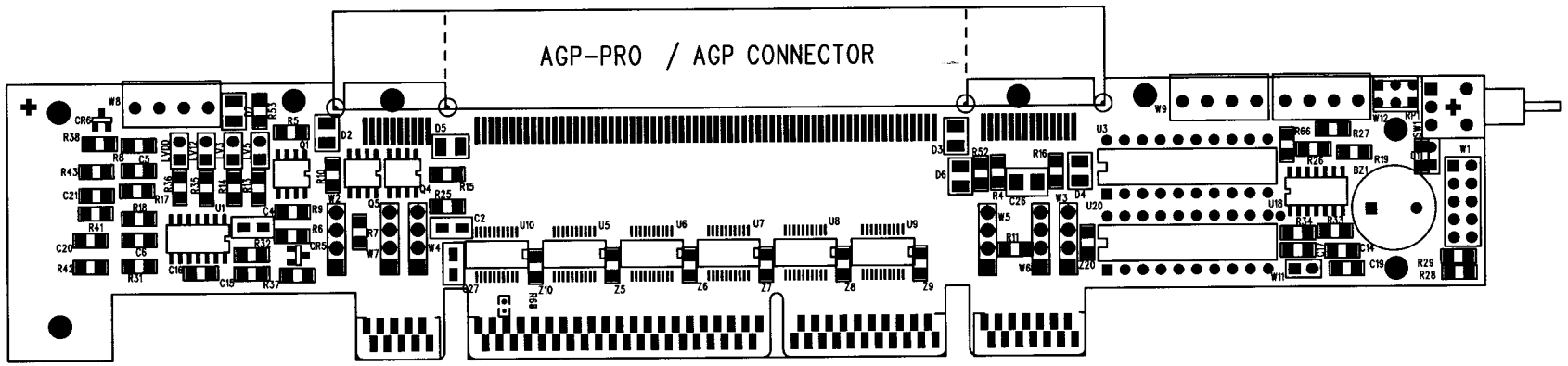
AGPROIX / AGPIX32 User's Manual



COMPONENT SIDE B

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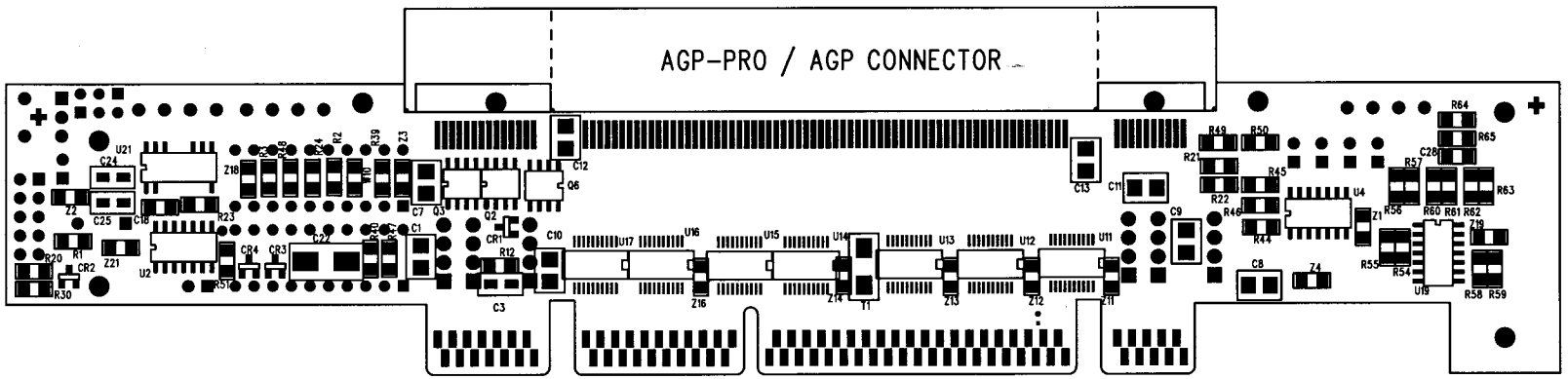

SOLDER SIDE A

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Adex Electronics, Inc.

USING PARALLEL PORT as EXTERNAL TTL CONTROL

The following information on the PC/AT parallel ports is provided for users, who wish to use the parallel port pins as the TTL control lines to the Bus Isolation Extenders. This assumes the parallel port to be in SPP mode.

1st Parallel Port: Data Register = 378h; Status Register = 379h;
Control Register = 37Ah; IRQ = 7

2nd Parallel Port: Data Register = 278h; Status Register = 279h;
Control Register = 27Ah; IRQ = 5

Data Register: Bit 0 - 7 = Data Bit 0 - 7

Status Register:	**Control Register:**
Bit 7 = /BUSY	Bit 7 = N/A
Bit 6 = /ACK	Bit 6 = N/A
Bit 5 = PE	Bit 5 = N/A
Bit 4 = SLCT	Bit 4 = IRQ_ENABLE
Bit 3 = /ERROR	Bit 3 = SLCT_IN
Bit 2 = N/A	Bit 2 = /INIT
Bit 1 = N/A	Bit 1 = AUTO_FEED
Bit 0 = N/A	Bit 0 = STROBE

The female 25 pin parallel port pin outs are:

1	/STROBE	(output)	14	/AUTO_FEED	(output)
2	Data 0	(I/O)	15	/ERROR	(Input)
3	Data 1	(I/O)	16	/INIT	(output)
4	Data 2	(I/O)	17	/SLCT_IN	(output)
5	Data 3	(I/O)	18	Gnd	
6	Data 4	(I/O)	19	Gnd	
7	Data 5	(I/O)	20	Gnd	
8	Data 6	(I/O)	21	Gnd	
9	Data 7	(I/O)	22	Gnd	
10	/ACK	(Input)	23	Gnd	
11	BUSY	(Input)	24	Gnd	
12	PE	(Input)	25	Gnd	
13	SLCT	(Input)			

Note:

1. /STROBE, BUSY, /AUTO_FEED, /SLCT_IN are inverted by Hardware (1 in software will appear as low at pin).
2. During power up, parallel port pins /STROBE, /AUTO_FEED, /SLCT_IN are reset to logic high; and /INIT is reset to logic low. After BIOS initialization, /INIT is toggled to high and /SLCT_IN is toggled to low.
3. Depending on the sequence of the BIOS initialization in each CPU system, one can use any of the signal pins, low or high to bring the extender up during cold boot. In some systems, an extra soft reboot by Ctrl Alt Del, after the first power up, may be necessary to get the plug and play boards to be recognized by BIOS.
4. The LED- pin on the W1 header on the Bus Isolation Extender could be connected to the SLCT pin on the parallel port (pin 13) as status input. The LED- at low will indicate successful bus connection and at high indicates no signal connection. The #Power_Control at pin 1 of the W1 header can also be used as a positive indication of cable connection and power connection. It can be connected to BUSY pin of the printer port for this purpose.
5. Some CPU systems may relocate the parallel port I/O addresses or may use 3BCh - 3BFh as the 1st parallel port /O addresses. One may verify the I/O addresses by looking at memory location 0:408h of ROM BIOS data areas using the DOS debug command.

External control can best be performed using the **MPIO (Multipurpose Power and I/O Controller)** product from Adex Electronics. One MPIO can control up to 4 bus isolation extenders directly and can also provide three external power with +/- 15% voltage margin at 2-3 amp, all under software control. For details, please see MPIO specification, under Adex web page, **http://www.adexelec.com**.

AGP / AGP-PRO BUS PINOUT

COMPONENT SIDE B	PIN NO.	SOLDER SIDE A
OVRCNT#	01	12V
5.0V	02	Reserved
5.0V	03	Reserved
USB+	04	USB-
GND	05	GND
INTB#	06	INTA#
CLK	07	RST#
REQ#	08	GNT#
VCC3.3	09	VCC3.3
ST0	10	ST1
ST2	11	Reserved
RBF#	12	PIPE#
GND	13	GND
Reserved	14	Reserved
SBA0	15	SBA1
VCC3.3	16	VCC3.3
SBA2	17	SBA3
SB_STB	18	Reserved
GND	19	GND
SBA4	20	SBA5
SBA6	21	SBA7
3.3VKEY / Reserved	22	3.3VKEY / Reserved
3.3VKEY / GND	23	3.3VKEY / GND
3.3VKEY / 3.3Vaux	24	3.3VKEY / Reserved
3.3VKEY / VCC3.3	25	3.3VKEY / VCC3.3
AD31	26	AD30
AD29	27	AD28
VCC3.3	28	VCC3.3
AD27	29	AD26
AD25	30	AD24
GND	31	GND
AD_STB1	32	Reserved
AD23	33	C/BE3#

AGP / AGP-PRO BUS PINOUT

COMPONENT SIDE B	PIN NO	SOLDER SIDE A
Vddq	34	Vddq
AD21	35	AD22
AD19	36	AD20
GND	37	GND
AD17	38	AD18
C/BE2#	39	AD16
Vddq	40	Vddq
IRDY#	41	FRAME#
1.5VKEY / 3.3Vaux	42	1.5VKEY / Reserved
1.5VKEY / GND	43	1.5VKEY / GND
1.5VKEY / Reserved	44	1.5VKEY / Reserved
1.5VKEY / VCC3.3	45	1.5VKEY / VCC3.3
DEVSEL#	46	TRDY#
Vddq	47	STOP#
PERR#	48	PME#
GND	49	GND
SERR#	50	PAR
C/BE1#	51	AD15
Vddq	52	Vddq
AD14	53	AD13
AD12	54	AD11
GND	55	GND
AD10	56	AD9
AD8	57	C/BE0#
Vddq	58	Vddq
AD_STB0	59	Reserved
AD7	60	AD6
GND	61	GND
AD5	62	AD4
AD3	63	AD2
Vddq	64	Vddq
AD1	65	AD0
Reserved	66	Reserved

AGP-PRO BUS PINOUT

COMPONENT SIDE D	PIN NO.	SOLDER SIDE C
VCC3.3	01	VCC3.3
VCC3.3	02	GND
VCC3.3	03	VCC3.3
VCC3.3	04	GND
VCC3.3	05	GND
VCC3.3	06	GND
VCC3.3	07	GND
VCC3.3	08	GND
PRSNT2#	09	Reserved
PRSNT1#	10	Reserved
COMPONENT SIDE F	**PIN NO.**	**SOLDER SIDE E**
Reserved	01	Reserved
Reserved	02	Reserved
GND	03	12V
GND	04	12V
GND	05	12V
GND	06	12V
GND	07	12V
GND	09	12V
GND	10	12V
GND	11	12V
GND	12	12V
GND	13	12V
GND	14	12V

WARRANTY

Adex Electronics warrants this product against defects in material and workmanship for a period of one year from the date of purchase. During the warranty period, Adex Electronics will repair or replace this product at no charge. This warranty does not apply if the product has been damaged by accident, abuse, misuse or misapplication, nor as a result of service or modification made by others.

Adex Electronics is not responsible for incidental or consequential damages resulting from use of this product. This includes damages to property and personal injury. The information in this manual has been carefully checked and is believed to be accurate. However, if there are any inaccuracies in this manual, Adex Electronics assumes no responsibility for any damages resulting from any omission or defects in this manual.

Caution! Handle and store this product in an electrostatic safe environment. ESD could damage this product.

Adex Electronics reserves the right to make changes in future product design without reservation and without notification to its users.

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