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AG300 Family

CTL01-3A-03, AMP01-2A-02

Hardware User's Manual

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Revision control table		
Version	Description	Date
1.0	Initial (based on Hardware Manual of previous hardware versions)	April 27, 2016
1.1	Corrections and additions by Gregory	April 28, 2016
1.2	Removed references to inversed polarity protections at J21	January 7, 2018
1.3	Added warning regarding plug in power manually. Removed the note that Ethernet is not available. It is.	April 15, 2018
1.4	Removing the notes that Regeneration, Static Brake and 5v fault detection are not supported (they are).	June 18, 2018
1.5	Add description of DIP Switches functionality.	July 25, 2018
1.6	Adding detailed specifications for isolated discrete outputs	July 27, 2018
1.7	Adding note about resistive/inductive loads of discrete outputs	August 15, 2018
1.8	Adding note about IO description	September 3, 2018
1.9	Few typo corrections	September 9, 2018
2.0	Added a note about connecting single-ended analog inputs	October 16, 2018
2.1	Added note about digital inputs 13 and 14	October 19,2018
2.2	Added dimension information and notes about external resistor usage	October 30,2018
2.3	Clearer warning about controller logic power supply connection.	March 17, 2019
2.4	Update the notes and descriptions for absolute and Sin/Cos encoder interfaces.	April 2, 2019
2.5	Add pin No information for the connectors	April 15, 2019

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Scope

This manual describes hardware interfaces of the AG300-CTL01-3A-03 (version 3) as a standalone controller and also as a complete control unit, when supplied as a drive, together with the AG300-AMP01-2A-02 (version 2).

This manual describes hardware interfaces of the following products:

Product description	Part numbers
Standalone controller	AG300-CTL01-3A-03-XX (version 3)
Complete control unit (AG300-DRV01): Controller + amplifier	AG300-CTL01-3A-03-XX (version 3) + AG300-AMP01-2A-02-XX (version 2)

The –XX defines a product's hardware variant, as describes below.

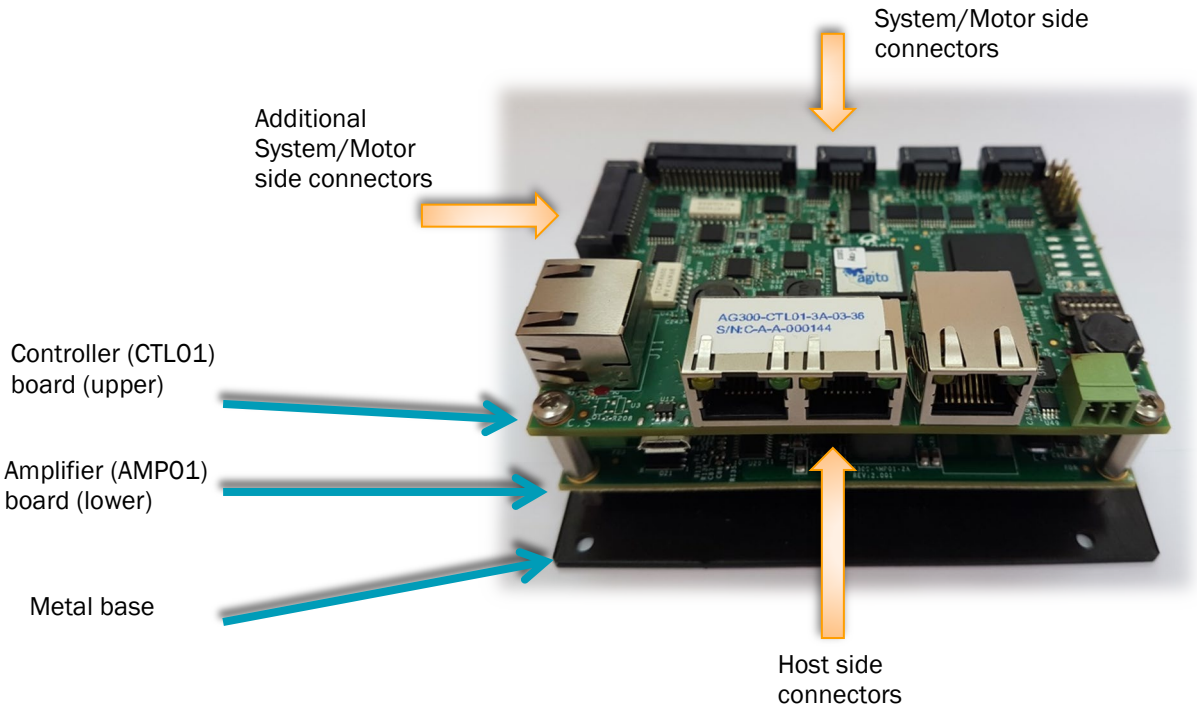
Product structure

AG300-CTL01-3A-03

The following picture shows the AG300-CTL01 controller board, as supplied for standalone operation (to be used with external amplifiers):

AG300-DRV01-2A-03

The following picture shows the AG300-DRV01-2A-03 control unit, which consists of the AG300-CTL01-3A-03 (controller board, version 3) and the AG300-AMP01-2A-02 (amplifier board, version 2). The DRV control unit is a full control unit, ready to connect directly to the motors.



Number of axes

The AG300-CTL01-3A-03 (controller board) supports control and interfaces for up to 3 axes.

The AG300-AMP01-2A-02 (amplifier board) supports driving of up to 2 motors.

This means that the integrated control unit (controller + amplifier) can control and drive up to 2 motors. However, please note that since the controller board is a 3 axes controller, a third axis can be controlled, if an external amplifier is connected (±10v command or Pulse/Direction command).

Supported motor types

The AG300 control unit can control and drive the following motor types:

- Up to 2 DC-Brushless, DC-Brush, Voice coil or Bipolar Stepper motors (each motor defined independently).
- Future firmware will also support, with no hardware change, control and driving of 3 Brush (or Voice coil) motors.

Linear and rotary motors are both supported.

Products' variants

The –XX at the end of the product's part number (see label on the product) defines the product's variant.

For the controller:

AG300-CTL01-3A-03-36:	Full variant. All hardware interfaces are assembled and included.

For the amplifier:

AG300-AMP01-2A-02-02:	Full variant for 20A Full Scale. All hardware interfaces are assembled and included. Up to 16A peak current. Up to 8A continuous current.
AG300-AMP01-2A-02-03:	Full variant for 10A Full Scale. All hardware interfaces are assembled and included. Up to 8A peak current. Up to 4A continuous current.
AG300-AMP01-2A-02-04:	Full variant for 5A Full Scale. All hardware interfaces are assembled and included. Up to 4A peak current. Up to 2A continuous current.

The following combination is right, for reference.
AG300C + DRV01-2A-0205= AG300-CTL01-3A-03-36+ AG300-AMP01-2A-02-03

Standalone controller – AG300-CTL01-3A-03

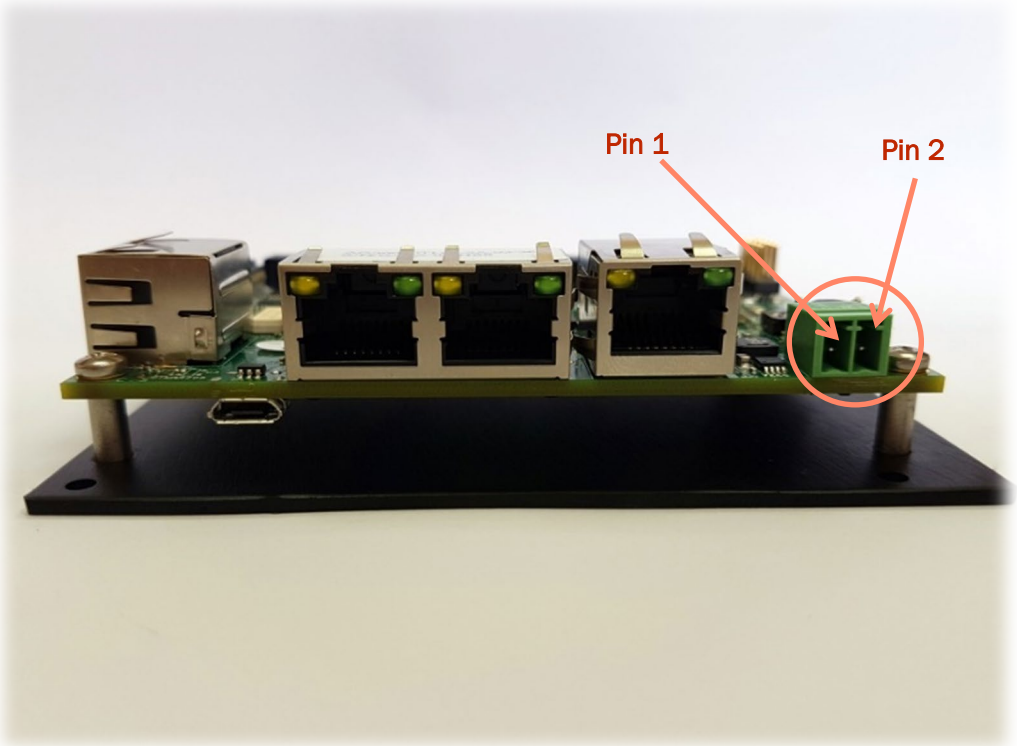
This document provides a detailed description of all the interfaces of the overall (DRV) control unit product (controller + amplifier). It does not provide a separate description of the interfaces of the standalone controller, as these interfaces are already described as part of the overall DRV product interfaces.

However, a single exception is the controller logic power connector, which is used only when using the controller as a standalone product. The following section describes this connector.

Logic power connector

This chapter describes the controller's logic power connector. This connector is used only for standalone operation of the controller.

Controller – J1 – Logic Power



Manufacturer:	DEGSON (Phoenix compatible)
P/N (product side):	15EDGRC3.502P1400AH
Pitch:	3.5mm

Warning!

Connect power to this connector (J1 - Logic Power) **only** if you are using the AG300-CTL01-3A product (controller board only, without a built-in amplifier board).

If you are using an AG300-DRV product (integrated controller and amplifier), power should be connected **only** to the amplifier power connector (J21, see later within this document).

Connecting power to "J1 – Logic Power" for an AG300-DRV unit may burn the unit and lead to permanent damage!

Pin #	Name	Type	Description
1	Logic Power	PWR - IN	9vDC – 36vDC (see above warning note!)
2	GND	PWR	Logic power ground

The controller includes a built-in protection to avoid damage in case of inversed polarity at the input power.

Note – Warning!

Hot plugging is not supported! Plug or unplug the power connector only when power is off! Plugging the power connector when it has power can lead to undesired high current through devices that are connected to the controller and damage these devices.

Control Unit (DRV) Interfaces

The following sections provide detailed definition of the connectors and the electrical interfaces of the controller board and the amplifier board when assembled as an integrated control unit (DRV) product.

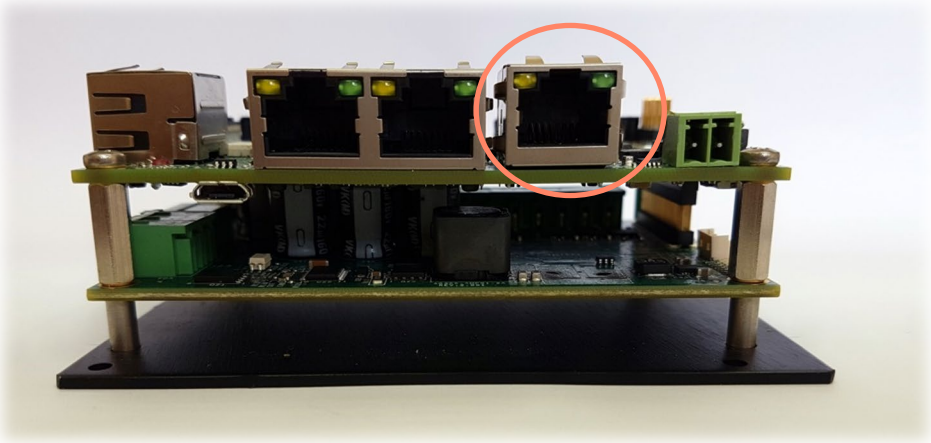
Controller board connectors

The chapter describes the connectors and interfaces of the controller board. This description is relevant both for standalone operation of the controller board, or when used within a complete control unit (DRV) with the amplifier board.

Host side interfaces

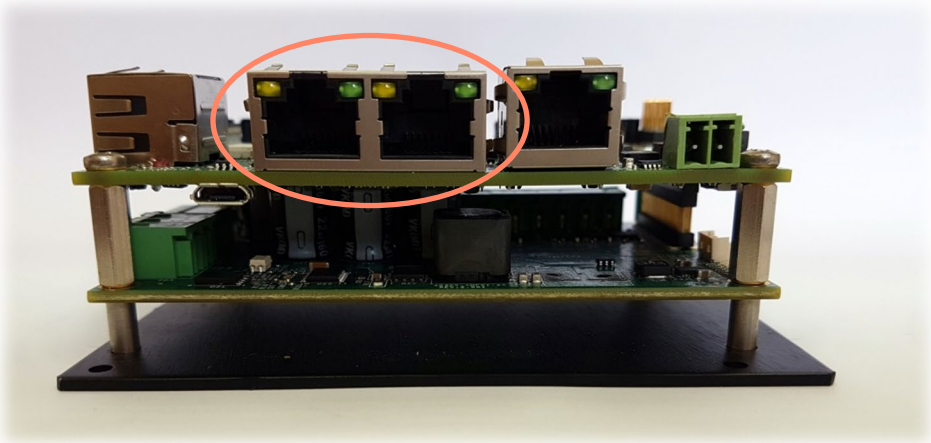
This section describes the connectors that are aimed to interface with the host computer (communication interfaces).

Controller – J2 – Ethernet



Description: RJ45 LAN 10/100Base-T Connector with magnetic
Cable: CAT5

Controller – J3/J4 – CAN Bus, RS-232 and RS-485



Description: RJ-45 8 pin right angle dual port

Note – Why dual port connector?

The J3/J4 connector is a dual port RJ45 connector (one is J3 and one is J4). The two ports have identical pinout and are interchangeable. Two ports are provided to support daisy chain connection of CAN Bus or RS-485. It can be also used to connect two types of communication channels at the same time, instead of splitting a cable from a single RJ45 connector.

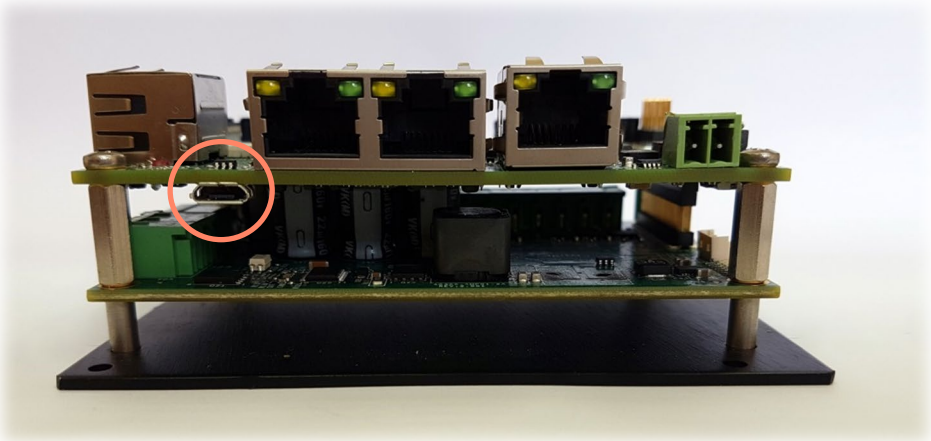
Pin #	Name	Type	Description
1	GND	PWR	Reference ground
2	RS232_RX	IN	RS2-32 input (comes towards AG300)
3	RS232_TX	Out	RS-232 output (comes from AG300)
4	RS485_B	In/Out	RS-485 bus, inverted
5	RS485_A	In/Out	RS-485 bus, not inverted
6	Sync	In/Out	Synchronization line (future use, consult Agito)
7	CAN_L	In/Out	CAN bus negative line
8	CAN_H	In/Out	CAN bus positive line

Notes – CAN Bus and RS-485 terminators:

The CAN Bus lines have optional 120 ohm terminator that is connected/disconnected by DIP Switch number 1 (refer to the chapter about the DIP Switches). Place DIP Switch number 1 at ON position to place a 120 ohms terminator on the lines (to be done at the last unit in the chain).

The RS-485 lines have built-in, fixed (not optional) 120 ohms terminator. This may degrade the communication performance in case too many units are placed on the RS-485 chain. Please consult Agito in such case (in future versions this built-in RS-485 terminator may be removed. In such case Agito will inform the customers in advance).

Controller – J5 – Micro USB



Description: CONN RCPT MICRO USB 2.0 B-Type

Note: RS-232 Bridge:

The Micro USB connection is implemented using an internal bridge from USB to RS-232 (UART). As a result, the communication performance, from the point of view of the user, is identical to RS-232, using a suitable software driver at the PC side.

For PC Software drivers, although in most cases they are automatically loaded, you may follow the link: http://www.ftdichip.com/Drivers/D2XX.htm

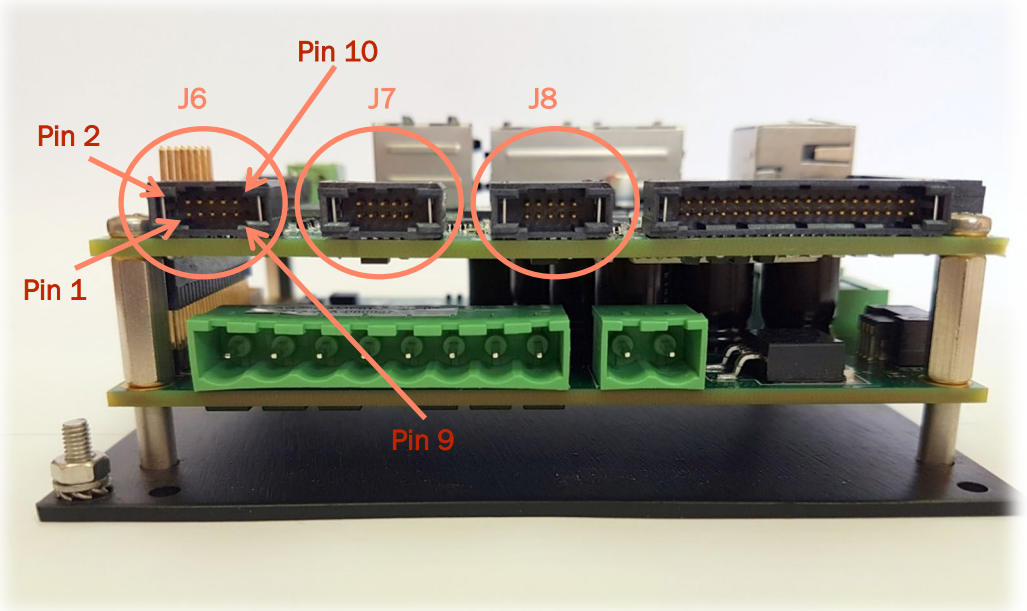
System/motor side interfaces

This section describes the connectors that are aimed to interface with the system side (encoders, I/O's...).

Controller – J6/J7/J8 – Encoders

J6, J7 and J8 are identical connectors. Each one is used to interface a single encoder, where J6 is typically used for A axis, J7 is typically used for B axis and J8 for C axis. Each encoder port supports various encoder types, as listed within this chapter, but with the following limitations:

1. Sin/Cos encoders are supported on ports A and B (J6 and J7) but not on port C.
2. EnDat2.2 absolute encoders are supported (for now, till a new version of the PCB will be announced) only for axes A and B, and they require a connection to port C as well.



Manufacturer: Samtec Inc.
P/N (product side): TFM-105-02-L-DH
Cable connector P/N: ISDF-05-D-M
Crimp P/N: CC03R-2830-01-G
Other options are possible; please, consult with the manufacturer.

Pin #	Name	Type	Description
1	5V	PWR - OUT	5V for user usage (up to 0.5A, each connector)
2	GND	PWR	Reference for 5V and differential signals
3	Encoder_1P	Out	Differential output, not inverted
4	Encoder_1N	Out	Differential output, inverted
5	Encoder_2P	In	Differential input, not inverted Used also for analog Sin/COS encoder (SIN+)
6	Encoder_2N	In	Differential input, inverted Used also for analog Sin/COS encoder (SIN-)
7	Encoder_3P	In	Differential input, not inverted Used also for analog Sin/COS encoder (COS+)
8	Encoder_3N	In	Differential input, inverted Used also for analog Sin/COS encoder (COS-)
9	Encoder_4P	Bidirectional	Differential input/output, not inverted Used also for analog Sin/COS encoder (INDEX+)
10	Encoder_4N	Bidirectional	Differential input/output, inverted Used also for analog Sin/COS encoder (INDEX-)

Several encoder options are available. For each type of encoder, the inputs and outputs are selected according to the table below:

Differential line	Incremental	Sin/Cos	SSI		BiSS	EnDat2.2	Nikon	Tamagawa	Panasonic
Encoder_1					OUT	OUT			
Encoder_2	IN- A	IN-SIN							
Encoder_3	**IN- B**	IN-COS	IN						IN
Encoder_4	**IN- Z**	IN-Z	OUT		IN	INOUT	INOUT	INOUT	OUT

Notes – Supported encoder types and connection of incremental encoder:

Currently only incremental encoder type is supported. SIN/COS analog encoders will soon be supported as well, to be followed also with absolute encoders support.

Note (see table above) that the A. B and Z channels of the encoder are connected to Encoder_2, Encoder_3 and Encoder_4 pins of the connector, respectively.

Note – Incremental encoder interface details:

The internal design of the A, B and Z signals interfaces supports, by default, differential inputs. However, with a dedicated assembly, it can support, without any external component, also single ended encoders. Please consult Agito in case your application uses single ended encoders or any other special, non-differential interface.

The default differential encoder's interface includes a built-in 120 ohms terminator (per each channel) and also the required hardware circuits to detect disconnected encoder cable (and in such case, the controller will disable the motor). The detection is done on the A and B channels only (and not on the index, Z, channel)

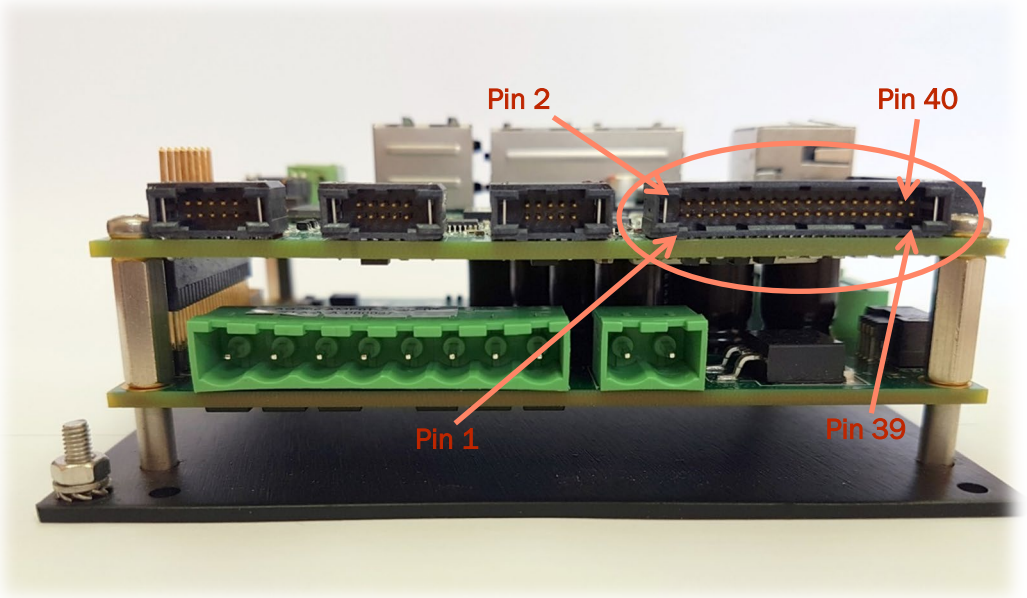
Note: 5v supply limitation:

Note that the 5v supply that is provided at pin 1 of each of the J6, J7 and J8 connectors is internally limited to 0.5A per each connector (independent limitation at each connector). This is in order to protect the controller from short to GND.

Controller – J9 – I/O Port (Isolated I/Os and Analog I/Os)

This section describes the details of J9, which provides the generic discrete, isolated, I/Os of the controller, as well as its analog outputs and 3 of its 4 analog inputs.

An additional analog input (number 4), as well as the isolated Abort input, is included within J10, which is described at the next section.



Manufacturer: Samtec Inc.
P/N (product side): TFM-120-02-L-DH
Cable connector P/N: ISDF-20-D-M
Crimp P/N: CC03R-2830-01-G
Other options are possible; please, consult with the manufacturer.

Pin #	Function	Type	Comments
1	OC_OUTPUT_1234_Common_Power	PWR - IN	Common power pin for discrete, isolated, outputs 1 to 4
2	OC_OUTPUT_1234_Common_Return	PWR	Common power return pin for discrete, isolated, outputs 1 to 4
3	Output 1, discrete, isolated.	OUT	1st isolated output, SW: DOutPort (bit 0). Programmable sink or source
4	Output 2, discrete, isolated.	OUT	2nd isolated output, SW: DOutPort (bit 1). Programmable sink or source
5	Output 3, discrete, isolated.	OUT	3rd isolated output, SW: DOutPort (bit 2). Programmable sink or source
6	Output 4, discrete, isolated.	OUT	4th isolated output, SW: DOutPort (bit 3). Programmable sink or source

Pin #	Function	Type	Comments
7	OC_INPUT_1234_Common	PWR - IN	Common pin (power or return, depending on external connection) for discrete, isolated, inputs 1 to 4
8	OC_INPUT_5678_Common	PWR - IN	Common pin (power or return, depending on external connection) for discrete, isolated, inputs 5 to 8
9	Input 1, discrete, isolated.	IN	1st isolated input, SW: DInPort (bit 0). NPN or PNP, depending on connection of the common pin of this group
10	Input 2, discrete, isolated.	IN	2nd isolated input, SW: DInPort (bit 1). NPN or PNP, depending on connection of the common pin of this group
11	Input 3, discrete, isolated.	IN	3rd isolated input, SW: DInPort (bit 2). NPN or PNP, depending on connection of the common pin of this group
12	Input 4, discrete, isolated.	IN	4th isolated input, SW: DInPort (bit 3). NPN or PNP, depending on connection of the common pin of this group
13	Input 5, discrete, isolated.	IN	5th isolated input, SW: DInPort (bit 4). NPN or PNP, depending on connection of the common pin of this group
14	Input 6, discrete, isolated.	IN	6th isolated input, SW: DInPort (bit 5). NPN or PNP, depending on connection of the common pin of this group
15	Input 7, discrete, isolated.	IN	7th isolated input, SW: DInPort (bit 6). NPN or PNP, depending on connection of the common pin of this group
16	Input 8, discrete, isolated.	IN	8th isolated input, SW: DInPort (bit 7). NPN or PNP, depending on connection of the common pin of this group
17	Input 9, discrete, isolated. (*)	IN	9th isolated input, SW: DInPort (bit 8). NPN or PNP, depending on connection of the common pin of this group
18	Common pin for discrete, isolated, inputs 9 to 11	PWR - IN	power or return, depending on external connection
19	Input 11, discrete, isolated. (*)	IN	11th isolated input, SW: DInPort (bit 10). NPN or PNP, depending on connection of the common pin of this group
20	Input 10, discrete, isolated. (*)	IN	10th isolated input, SW: DInPort (bit 9). NPN or PNP, depending on connection of the common pin of this group
21	5v supply for external I/O circuits.	PWR - OUT	Limited to 0.5A, pins 21 and 23 together.
22	GND	PWR	GND for 5V and differential signals
23	5v supply for external I/O circuits.	PWR - OUT	Limited to 0.5A, pins 21 and 23 together.
24	GND	PWR	GND for 5V and differential signals
25	+VA (15V)	PWR – OUT	Low current +15v supply for external analog circuits
26	-VA (-15V)	PWR – OUT	Low current +15v supply for external analog circuits
27	Analog Output 1	OUT	±12v, 16 bit. SW: AOutPort[1].
28	Analog Output 1 Return	OUT	

Pin #	Function	Type	Comments
29	Analog Output 2	OUT	±12v, 16 bit. SW: AOutPort[2].
30	Analog Output 2 Return	OUT	Must connect to GND if analog input is single-ended.
31	Analog Output 3	OUT	±12v, 16 bit. SW: AOutPort[3].
32	Analog Output 3 Return	OUT	
33	Analog Output4	OUT	±12v, 16 bit. SW: AOutPort[4].
34	Analog Output 4 Return	OUT	
35	Analog Input 1	IN	±12v, 12 bit. SW: AInPort[1] and AInPort[5]
36	Analog Input 1 Return	IN	Must connect to GND if analog input is single-ended.
37	Analog Input 2	IN	±12v, 12 bit. SW: AInPort[2] and AInPort[6]
38	Analog Input 2 Return	IN	Must connect to GND if analog input is single-ended.
39	Analog Input 3	IN	±12v, 12 bit. SW: AInPort[3] and AInPort[7]
40	Analog Input 3 Return	IN	Must connect to GND if analog input is single-ended.

(*) The organization of the pins for discrete, isolated, inputs 9 to 11 is different from the organization for the groups of inputs 1 to 4 and inputs 5 to 8. This is not a documentation mistake. Indeed the organization is different.

Note – Analog output are not supported in some of the product variants:

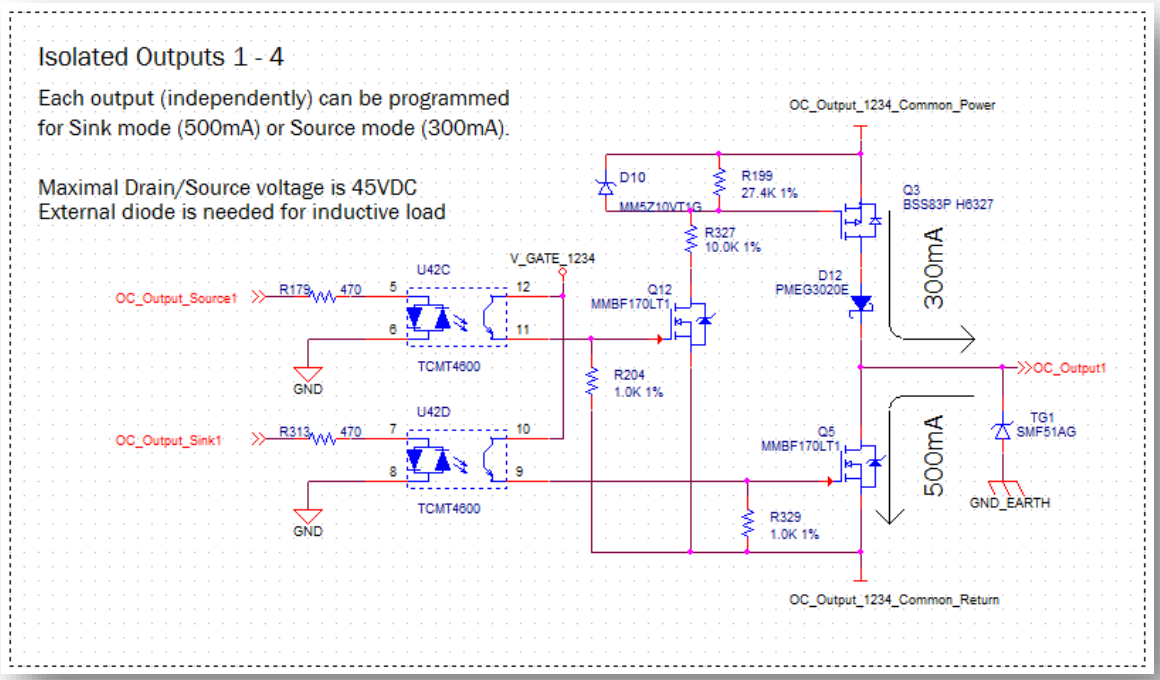
Some variants of the product do not support the analog outputs. Please consult Agito for ordering the correct variant in case you need analog outputs for your application.

Analog outputs are required in case you need to interface external amplifier over a ±10v analog command, or in case you need analog output for any other general purpose.

Note: 5v supply limitation:

Note that the 5v supply that is provided on pins 21 and 23 is internally limited to 0.5A (both pins together). This is in order to protect the controller from short to GND.

Electrical interfaces – Discrete, Isolated, outputs:



- The interface circuit is identical for outputs 2 to 4.
- Each output can be programmed (by a software parameter) to act as a current sourcing output (up to 300mA) or as a current sinking output (up to 500mA).
- Common power is shared by all 4 outputs.
- The outputs are designed for resistive loads. For inductive loads, an external flyback diode is required.
- Discrete outputs specifications:

  - Discrete outputs common power voltage range is 5v to 36v.
  - Maximal load current, per each output:

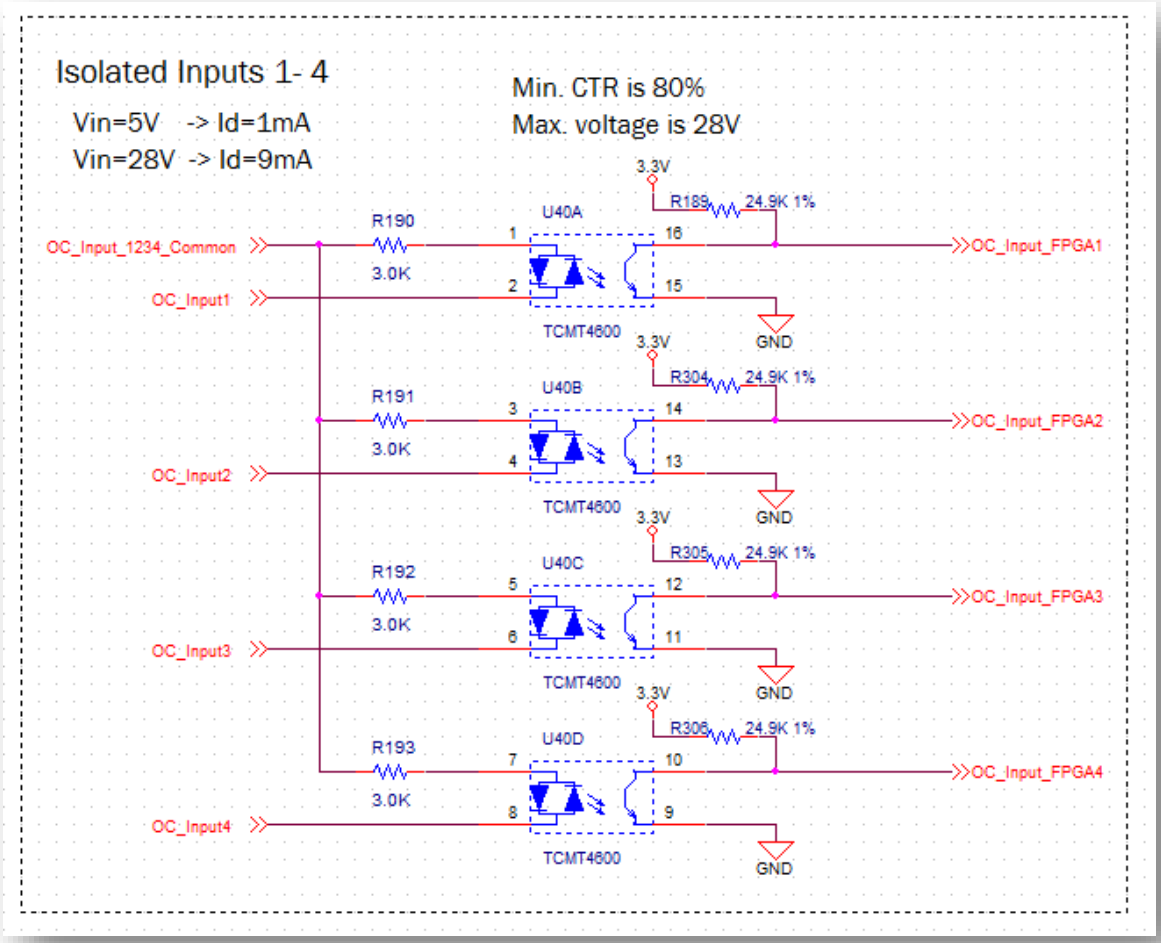
    a. SINK mode, at any common power voltage: 500mA
    b. SOURCE mode, at 24v common power voltage: 300mA.
    c. SOURCE mode, at 5v common power voltage: 60mA
    (Output high voltage > 4.5v).

  Notes:

    1. Higher currents (but less than absolute maximal value of 250mA) can be driven at SOURCE mode with 5v common power voltage. However, the output high voltage will drop significantly.

2. For additional and more detailed data, please write to our support team.

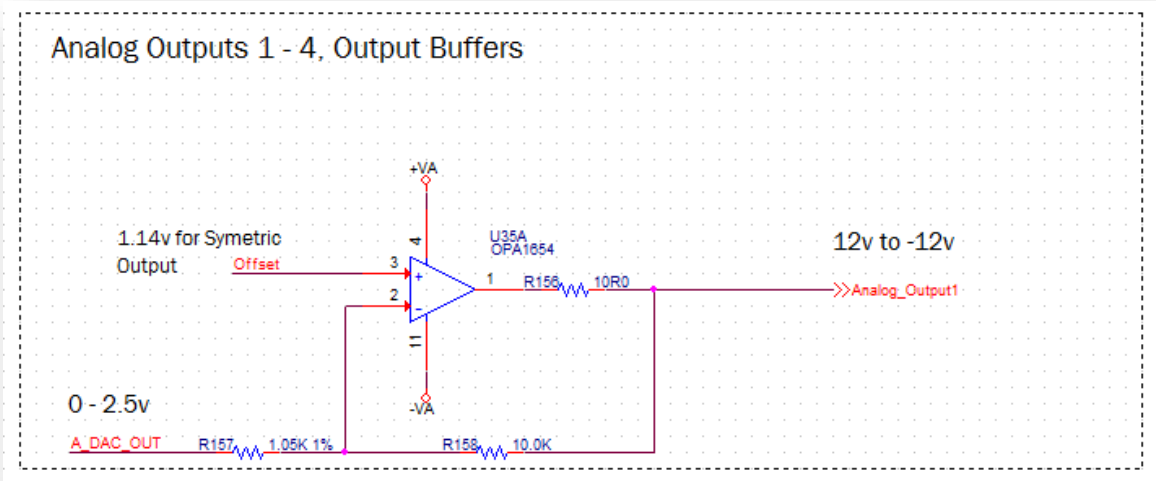
Electrical interfaces – Discrete, Isolated, inputs:



- The interface circuit is identical for inputs 1 to 4, which are organized as a single group.
- Similarly, inputs 5-8 are organized as a group with an identical interface circuits and inputs 9-11 are a third independent group.
- Each group is fully isolated and independent of the other groups.
- Each group can be connected as NPN or PNP interfaces, depending on the wiring of the group common pin. If the common pin is connected to power (5v to 28v), then the inputs of this group can be used with external NPN devices (external current sinking devices). If the common is connected to the GND of some external power, then the inputs can be used with external PNP devices (external current sourcing devices).
- Note that the input circuit of the opto couplers includes two diodes. This enables the usage as NPN of PNP.

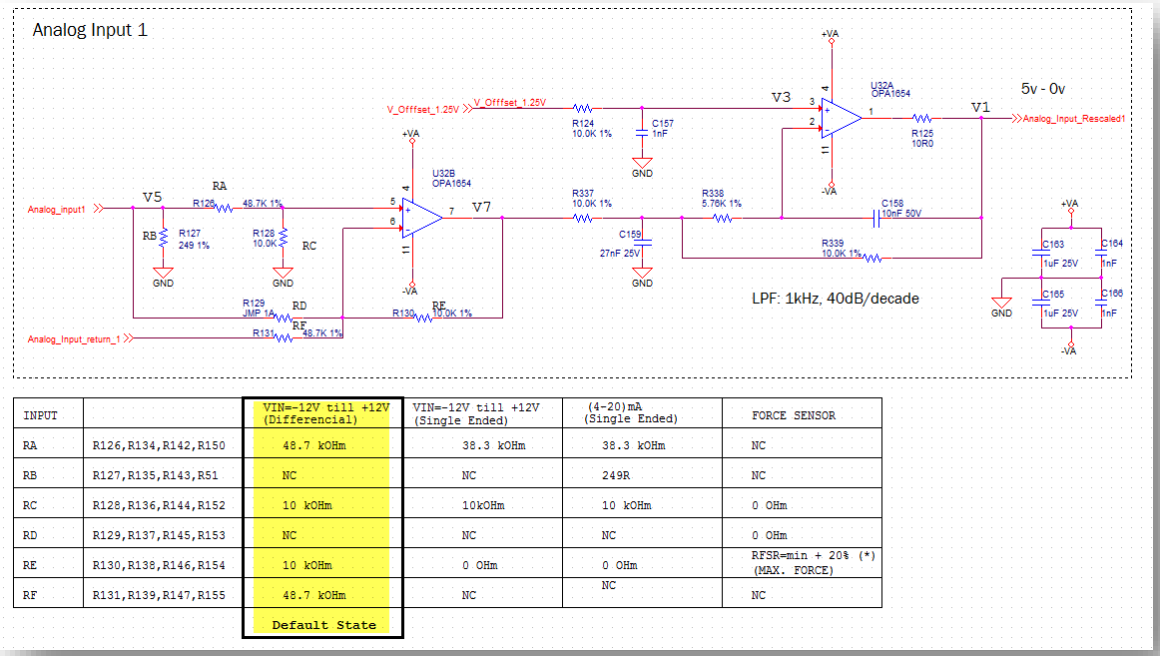
- Clearly, one group can be wired to interface external NPN devices and another group can be wired to interface PNP devices. However, within a group, all interfaces should be the same, as they are based on the connection of the group common pin.

Electrical interfaces – Analog outputs:



- The electrical interfaces of analog outputs 2 to 4 are identical to those of analog output 1.
- The analog outputs are -12v to +12v, 16 bits.
- Output resistance is 10ohms.
- Output current is up to ±2mA, without internal current limitation.
- Analog outputs are controlled by the controller software in few operational modes:
  - Analog command to external amplifier.
  - Analog output controlled by the user for any generic purpose.
  - Analog output reflects the internal value of a user selected parameter (position, position error, velocity, current and actually any parameter/status of the controller), with a user defined scaling, for easy monitoring using an oscilloscope.

Electrical interfaces – Analog inputs:



INPUT		VIN=-12V till +12V (Differencial)	VIN=-12V till +12V (Single Ended)	(4-20)mA (Single Ended)	FORCE SENSOR
RA	R126,R134,R142,R150	48.7 kOHm	38.3 kOHm	38.3 kOHm	NC
RB	R127,R135,R143,R51	NC	NC	249R	NC
RC	R128,R136,R144,R152	10 kOHm	10kOHm	10 kOHm	0 OHm
RD	R129,R137,R145,R153	NC	NC	NC	0 OHm
RE	R130,R138,R146,R154	10 kOHm	0 OHm	0 OHm	RFSR=min + 20% (*) (MAX. FORCE)
RF	R131,R139,R147,R155	48.7 kOHm	NC	NC	NC
		Default State			

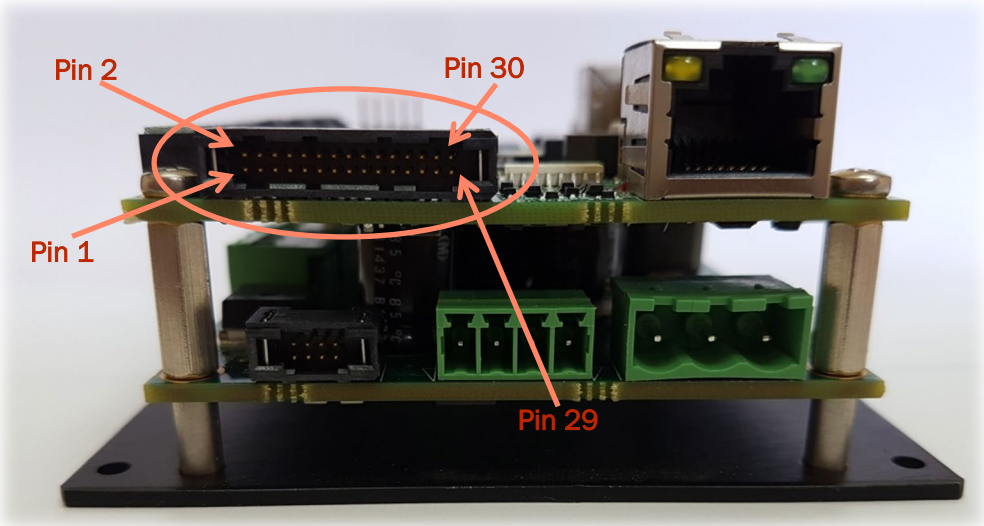
- The electrical interfaces of analog inputs 2 to 4 are identical to those of analog input 1.
- The analog inputs are -12v to +12v, 12 bits.
- The input circuit drawing is quite complex, in order to optionally support variety of analog input sources. However, the default assembly (see yellow mark) is for standard differential analog input, with a simple input circuit, having an input resistance of ~60K ohms.
- For single-ended analog inputs, take care to connect the return line to GND. Do not leave it open.
- Input circuit bandwidth: 1KHz, -40 db/dec.
- For dedicated (non-differential) analog input formats, as shown in the above table, or for any other type, please consult Agito for dedicated hardware variants of the product.
- The controller software provides parameters to control the analog input reading, as follows:
  - ❖ Filter.
  - ❖ Offset.
  - ❖ Dead band.
  - ❖ Gain.

Additional System/motor side interfaces

This section describes the additional connectors that are aimed to interface with the system side (additional I/O's...).

Controller – J10 – Additional I/Os Port (Mainly Differential I/Os)

This section describes the details of J10, which provides the generic discrete, differential, I/Os of the controller, as well as the 4th analog input and the discrete, isolated, Abort input.



Manufacturer: Samtec Inc.
P/N (product side): TFM-115-02-L-DH
Cable connector P/N: ISDF-15-D-M
Crimp P/N: CC03R-2830-01-G
Other options are possible; please, consult with the manufacturer.

Pin #	Name	Type	Description
1	Analog Input 4	IN	±12v, 12 bit. SW: AInPort[4] and AInPort[8]
2	Analog Input 4 Return	IN	Must connect to GND if analog input is single-ended.
3	Abort+ Isolated input (*)	IN	Isolated input number 12, SW: DInPort(bit 11)
4	Abort- Isolated input (*)	IN	
5	Input 15, differential, positive pin	IN	1st differential input, SW: DInPort(bit 14)

Pin #	Name	Type	Description
6	Input 15, differential, negative pin	IN	
7	Input 16, differential, positive pin	IN	2nd differential input, SW: DInPort(bit 15)
8	Input 16, differential, negative pin	IN	
9	Input 17, differential, positive pin	IN	3rd differential input, SW: DInPort(bit 16)
10	Input 17, differential, negative pin	IN	
11	Input 18, differential, positive pin	IN	4th differential input, SW: DInPort(bit 17)
12	Input 18, differential, negative pin	IN	
13	Input 19, differential, positive pin	IN	5th differential input, SW: DInPort(bit 18)
14	Input 19, differential, negative pin	IN	
15	Input 20, differential, positive pin	IN	6th differential input, SW: DInPort(bit 19)
16	Input 20, differential, negative pin	IN	
17	Input 21, differential, positive pin	IN	7th differential input, SW: DInPort(bit 20)
18	Input 21, differential, negative pin	IN	
19	Input 22, differential, positive pin	IN	8th differential input, SW: DInPort(bit 21)
20	Input 22, differential, negative pin	IN	
21	Output 5, differential, positive pin	OUT	1st differential output, SW: DOutPort (bit 4).
22	Output 5, differential, negative pin	OUT	
23	Output 6, differential, positive pin	OUT	2nd differential output, SW: DOutPort (bit 5).
24	Output 6, differential, negative pin	OUT	
25	Output 7, differential, positive pin	OUT	3rd differential output, SW: DOutPort (bit 6).
26	Output 7, differential, negative pin	OUT	
27	Output 8, differential, positive pin	OUT	4th differential output, SW: DOutPort (bit 7).
28	Output 8, differential, negative pin	OUT	
29	GND	PWR	GND for the differential I/Os
30	GND	PWR	GND for the differential I/Os

Note:

Inputs 13 and 14 (bits 12 and 13 at DInPort) are not tied to any physical input and should be ignored (at new FPGA versions they are always 0).

(*) The Abort input is a software safety mechanism, to disable all motors, by software. The motors are disabled when there is no current at this specific input and the user has no access to bypass this logic. However, at the moment, this feature is not supported and the Abort input is considered, by the software, just as any other discrete, isolated input.

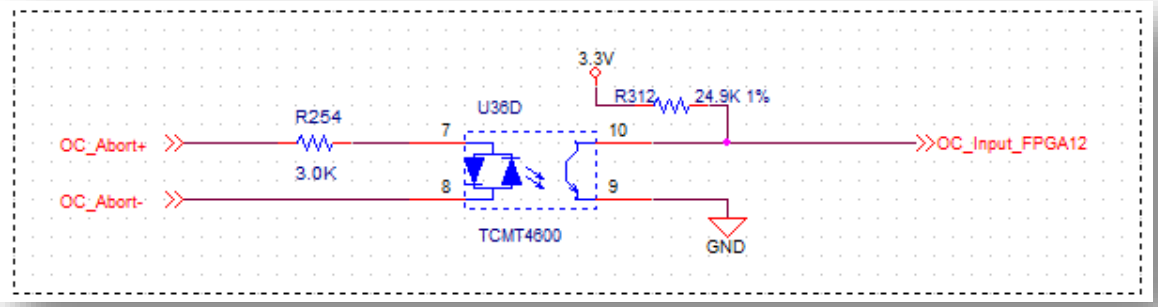
Still, the user can define, by software parameters, that any of the inputs can be used to automatically disable any motor, with a programmable logic (active high or active low).

The Abort input functionality, as described above, will be added as part of one of the controller firmware future versions.

Electrical interfaces – Analog input:

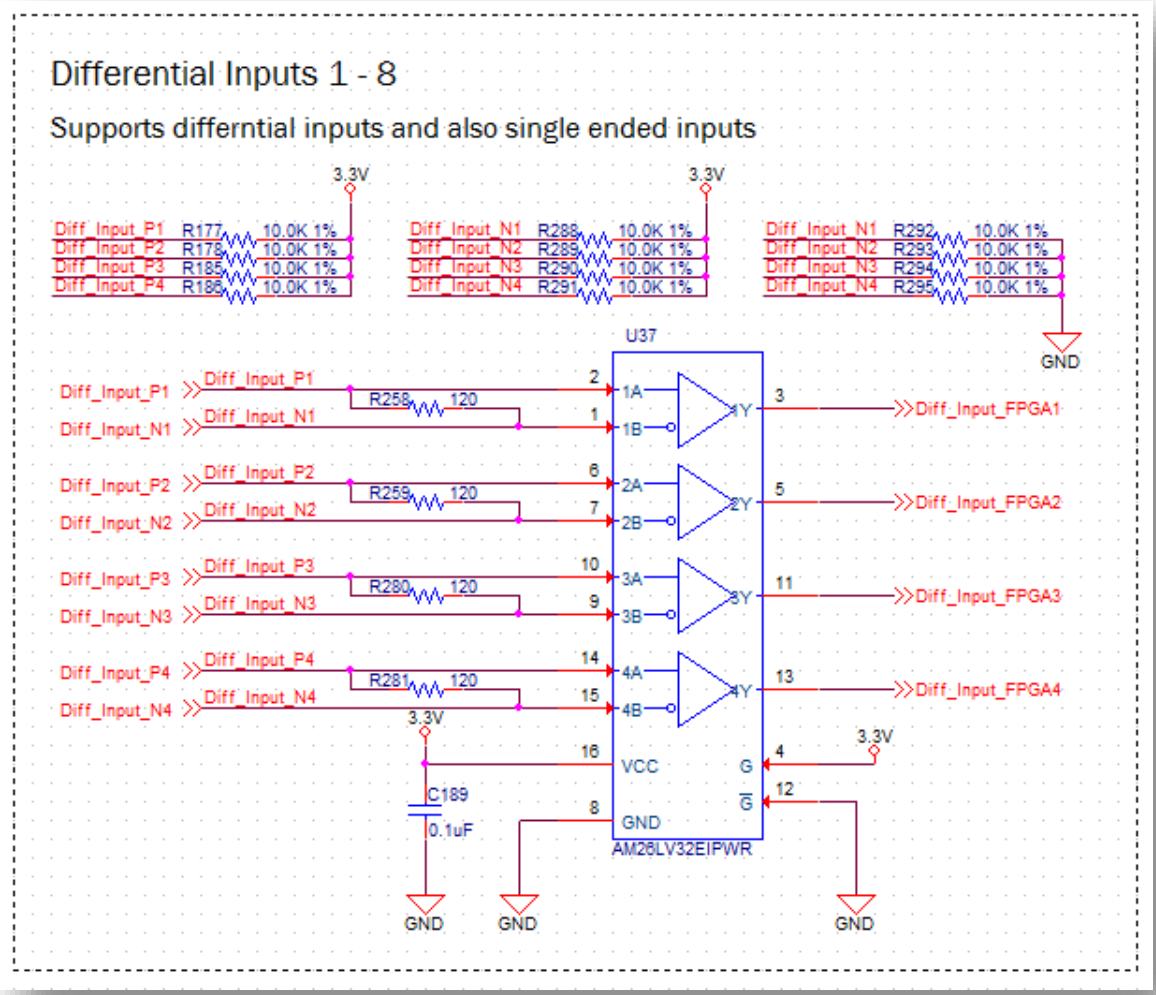
Please refer to the previous section (J9 connector).

Electrical interfaces – Abort input:



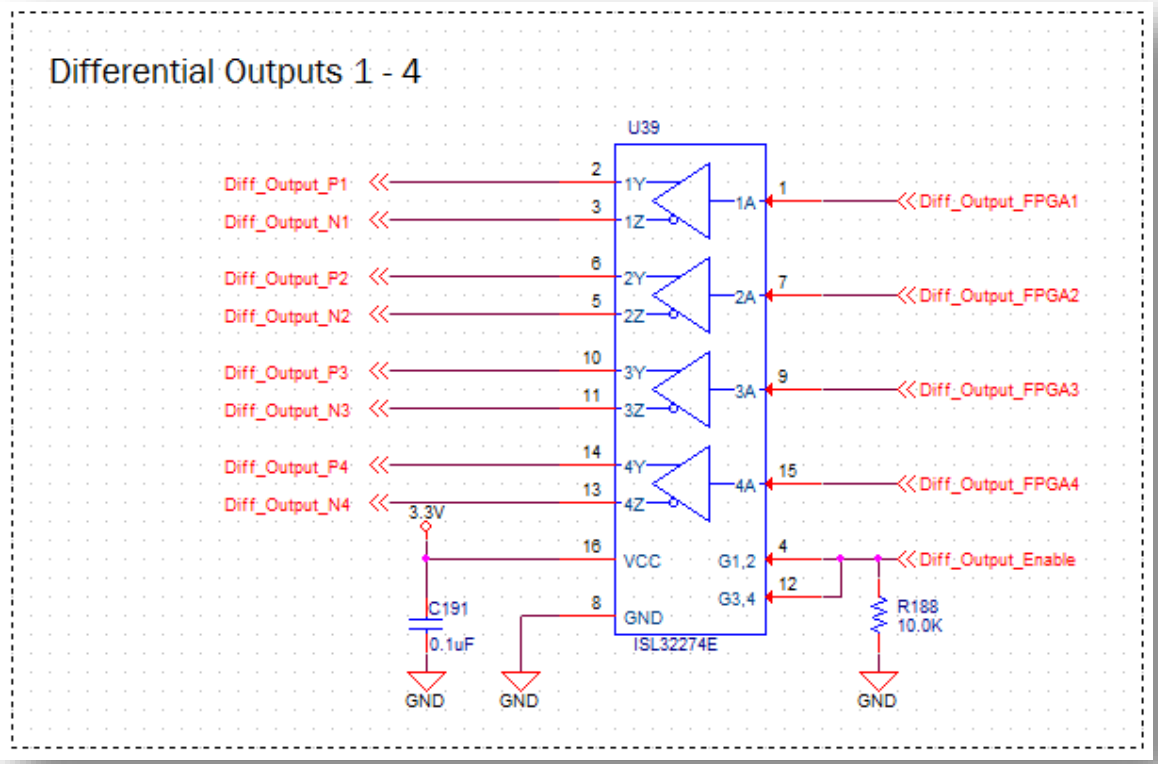
- It is clearly seen from this interface circuit (two diodes at the opto coupler input circuit) that the Abort input can work with positive and negative polarity.
- The voltage and current ratings of the Abort input is identical to those of the discrete, isolated, inputs (see the chapter about J9 connector).

Electrical interfaces – Differential inputs:



- The electrical interfaces of differential inputs 5 to 8 are identical to those of inputs 1 to 4.
- Note that each differential input has 120 ohms terminator.
- Note that each differential input has pull-up to 3.3V on its positive pin and pull down to GND on is negative pin. This ensures that the input is not floating when not connected and that its reading is known and fixed.
- Note that the negative input pin, on each differential input, has also a pull-up to 3.3V. This enables the usage of a differential input with a single-ended source, by connecting it to the positive input only and leaving the negative pin disconnected.
- The differential inputs can be used with 5v differential sources.

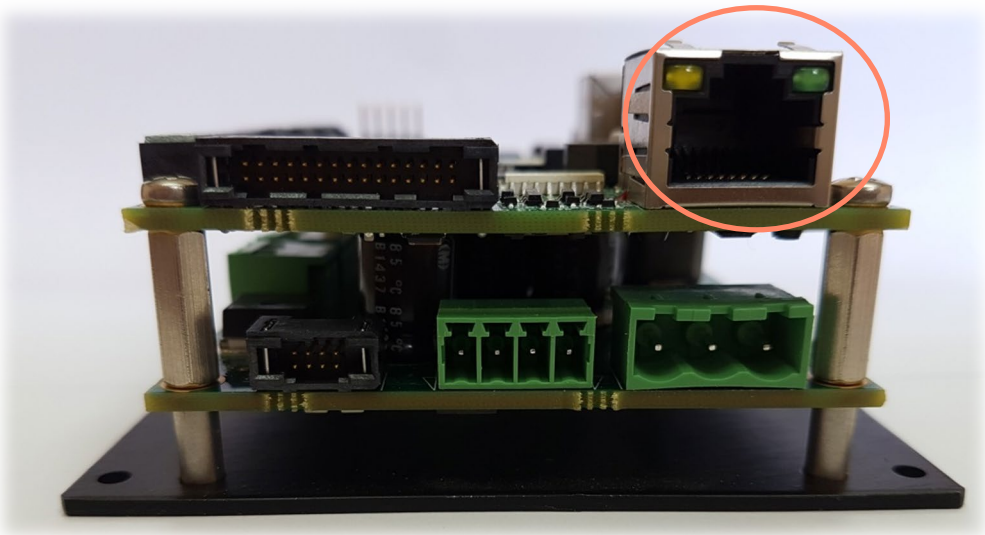
Electrical interfaces – Differential outputs:



- The differential outputs are disabled immediately after power on, till they are controlled by the software and the user defined parameters.

Controller – J11 – Central-i

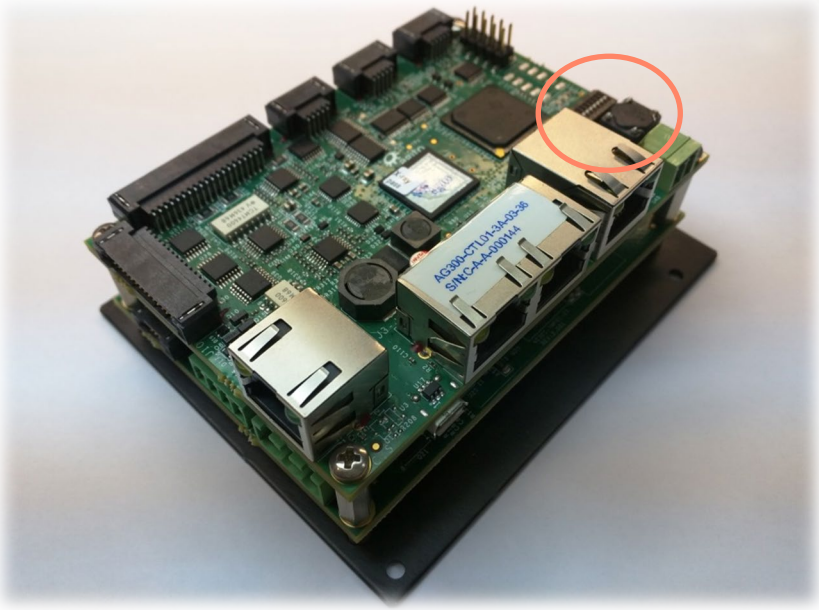
This connected is for a future functionality of the controller. In some variants of the product it is not even assembled. Please do not use this connector.



Description: CONN RJ45 8P8C R/A SHLD, LEDs

DIP Switches

The controller board includes 8 DIP switches as shown in the following figure:



The DIP switches have few purposes, such as defining the address offset of the unit over a CAN Bus daisy chain connection or Ethernet IP value and also some other internal purposes, all as described in the following table.

DIP Switch 1 has a dedicated hardware function. It places a 120 ohms terminator on the CAN bus lines when the DIP Switch is in its ON position and disconnects the terminator when the switch is at its OFF position.

The state of this switch is important only if you use CAN Bus communication. In such case, the last unit in the chain should have this DIP Switch at ON position, while all other units should have it at OFF position.

DIP Switch #	Function	Description
1	CAN Bus terminator	See above.
2	Force download FW	Keep always at off state.
3	Force all defaults	Forces the controller to default communication parameters as follows (bypassing other parameters in the controller): Ethernet IP: 172.1.1.101 Ethernet Port: 50000 CAN Address: 64 Note that CAN and RS232/USB baud rates are not affected by this DIP Switch.
4-6	CAN/Ethernet Address DIP Switch 4 – Most significant DIP Switch 6 – Least significant	DIP Switches 4-5-6 creates a three bits value. For example, if DIP Switch 4 is ON (value of 1), 5 is OFF (value of 0) and 6 is OFF, we get: 100 (binary), which means a value of 4. This value (refers below as "offset") is used to define the controller address for CAN Bus and the controller IP for Ethernet, as follows: Ethernet IP: the actual 4th number of the IP definition is equal to: EthernetIP[4] + offset CAN address: the actual CAN address of the unit is equal to: CANAddr + offset * 16
7	Not used	Keep always at off state.
8	Not used	Keep always at off state.

Note:

The state of DIP Switches 2-7 is read by the controller software only once, during power on or reset process. Changing the DIP Switches (2–7) while the controller is working has no effect and will take effect only once the controller is reset or power cycled.

The value of the DIP Switches, as read by the controller during power on (or reset) can be inquired using ADebugData[4] at the terminal.

Note:

In future FW versions, DIP Switches 3 and 4-6 will also affect the RS-485 controller address.

Amplifier board connectors

The chapter describes the connectors and interfaces of the amplifier board.

Host side interfaces

No connectors at this side. The amplifier is not interfacing with the Host.

System/motor side interfaces

This section describes the connectors that are aimed to interface with the system side (unit power, motor phases…).

Amplifier – J21 – Unit power

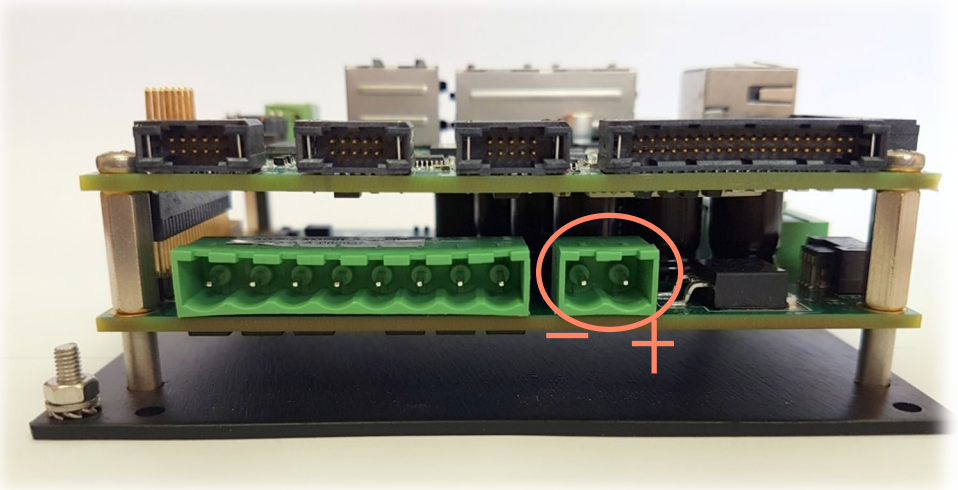
J21 is used to supply power to the overall unit. The input voltage is directly connected to the amplifier power bridge, to driver the motors, and in parallel it is used to generate internal logic power in order to power the controller board.

The control unit is fully operational with this single power supply.

Note – Optional schemes for isolated power supplies:

The AG300 controller and amplifier are designed to support fully isolated power supplies, one for the amplifier and the motor and one for the controller. Such operation requires a dedicated hardware variant. Please consult Agito in case you would like to consider this scheme.

The amplifier does not include a protection against inversed polarity at the input power.



Manufacturer: DEGSON (Phoenix compatible)
P/N (product side): 2EDGRC5.0802P14H
Pitch: 5.08mm

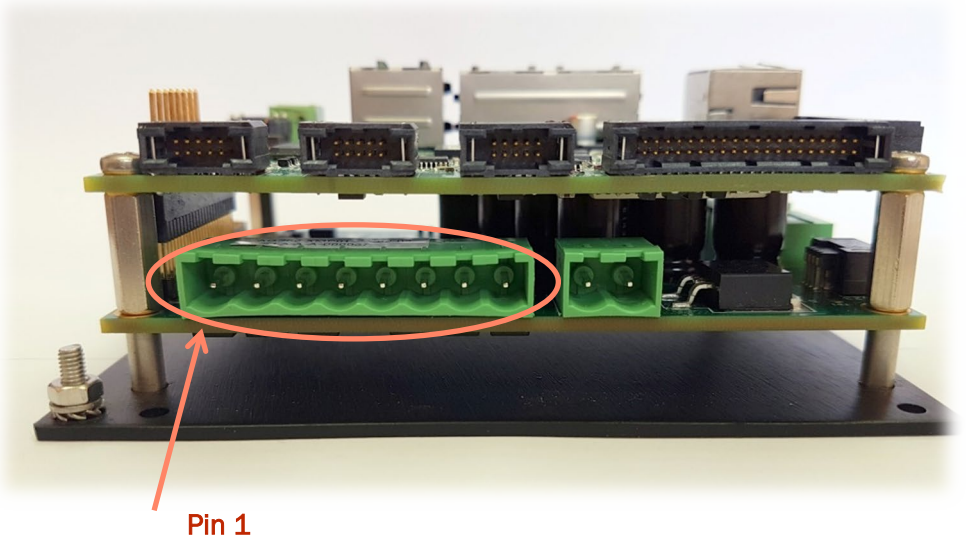
Pin #	Name	Type	Description
1	Power GND	PWR	Power GND
2	Main Power	PWR	Motor power input: 12V to 90V, up to 16A continuous

Note – Warning!

Hot plugging is not supported! Plug or unplug the power connector only when power is off! Plugging the power connector when it has power can lead to undesired high current through devices that are connected to the controller and damage these devices.

Amplifier – J22 – Motor Phases

J22 is used to connect to the motors' phases. Connection depends on the motor type, as described below.



Manufacturer: DEGSON (Phoenix compatible)
P/N (product side): 2EDGRC5.0808P14H
Pitch: 5.08mm

For two Brushless motors:

Pin #	Name	Type	Description
1	Motor A Phase A	PWR	
2	Motor A Phase B	PWR	
3	Motor A Phase C	PWR	
4	Chassis	Chassis	Use for screening of the motor cable
5	Chassis	Chassis	Use for screening of the motor cable
6	Motor B Phase A	PWR	
7	Motor B Phase B	PWR	
8	Motor B Phase C	PWR	

For two Brush (or voice coil) motors:

Pin #	Name	Type	Description
1	Motor A Phase +	PWR	

2	Motor A Phase -	PWR	
3	NC	PWR	Do not connect
4	Chassis	Chassis	Use for screening of the motor cable
5	Chassis	Chassis	Use for screening of the motor cable
6	Motor B Phase +	PWR	
7	Motor B Phase -	PWR	
8	NC	PWR	Do not connect

For two Stepper motors:

Pin #	Name	Type	Description
1	Motor A Phase 1 +	PWR	
2	Motor A Phase 2 +	PWR	
3	Motor A Phases 1 and 2 -	PWR	Two motor wires are connected to a single pin of the connector
4	Chassis	Chassis	Use for screening of the motor cable
5	Chassis	Chassis	Use for screening of the motor cable
6	Motor B Phase 1 +	PWR	
7	Motor B Phase 2 +	PWR	
8	Motor A Phases 1 and 2 -	PWR	Two motor wires are connected to a single pin of the connector

Note – Stepper voltage range:

Note that a bipolar stepper motor has two independent phases (total of 4 wires). With the AG300-AMP01, you need to connect the (-) wire of both phases together, into the third pin of the connector (for motor A) or the 8th pin (for motor B).

This connection implies a limitation of the voltage that will be applied to the stepper. For example, if the power supply to the unit is 24v, each phase of the stepper motor will be limited to 12v.

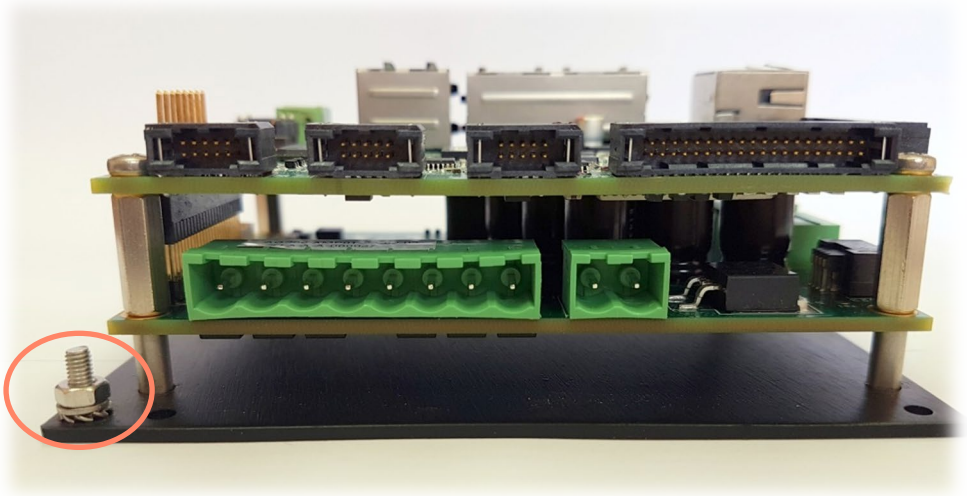
With suitable selection of the power supply this should impose no limitation on the stepper motor operation.

User may connect different types of motors to motor A and to motor B. Just follow the above instructions for each motor, independently.

In the future, the product will also support controlling and driving of three Brush (or Voice coil) motors, with no hardware change.

External connection to the chassis

The AG300 unit is equipped with a screw on the product's base, aimed for chassis connection (power supply cable, shielding of other cables, etc.)m as shown in the following figure:

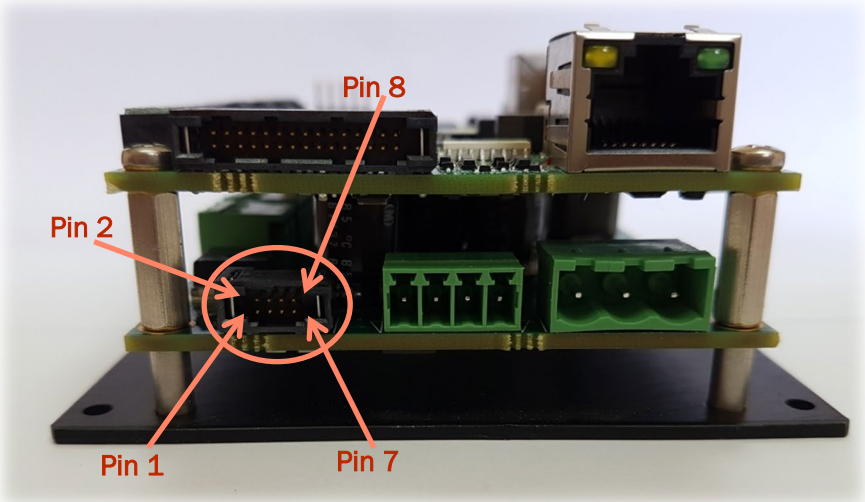


The chassis, within the product, is not connected to the power supply ground.

Additional System/motor side interfaces

This section describes the additional connectors that are aimed to interface with the system side (STO, Static brakes and regeneration).

Amplifier – J23 – STO



Manufacturer: Samtec Inc.
P/N (product side): TFM-104-02-L-DH
Cable connector P/N: ISDF-04-D-M
Crimp P/N: CC03R-2830-01-G
Other options are possible; please, consult with the manufacturer.

Pin #	Name	Type	Description
1	STO1-	IN	Safe Torque Off 1 negative input
2	STO1+	IN	Safe Torque Off 1 positive input
3	STO2-	IN	Safe Torque Off 2 negative input
4	STO2+	IN	Safe Torque Off 2 positive input
5	STOFB-	OUT	Safe Torque Off 1 negative (emitter) output
6	STOFB+	OUT	Safe Torque Off 1 positive (collector) output
7	5v	PWR - OUT	5v supply for STO circuits
8	GND	PWR	GND

Notes – STO Implementation:

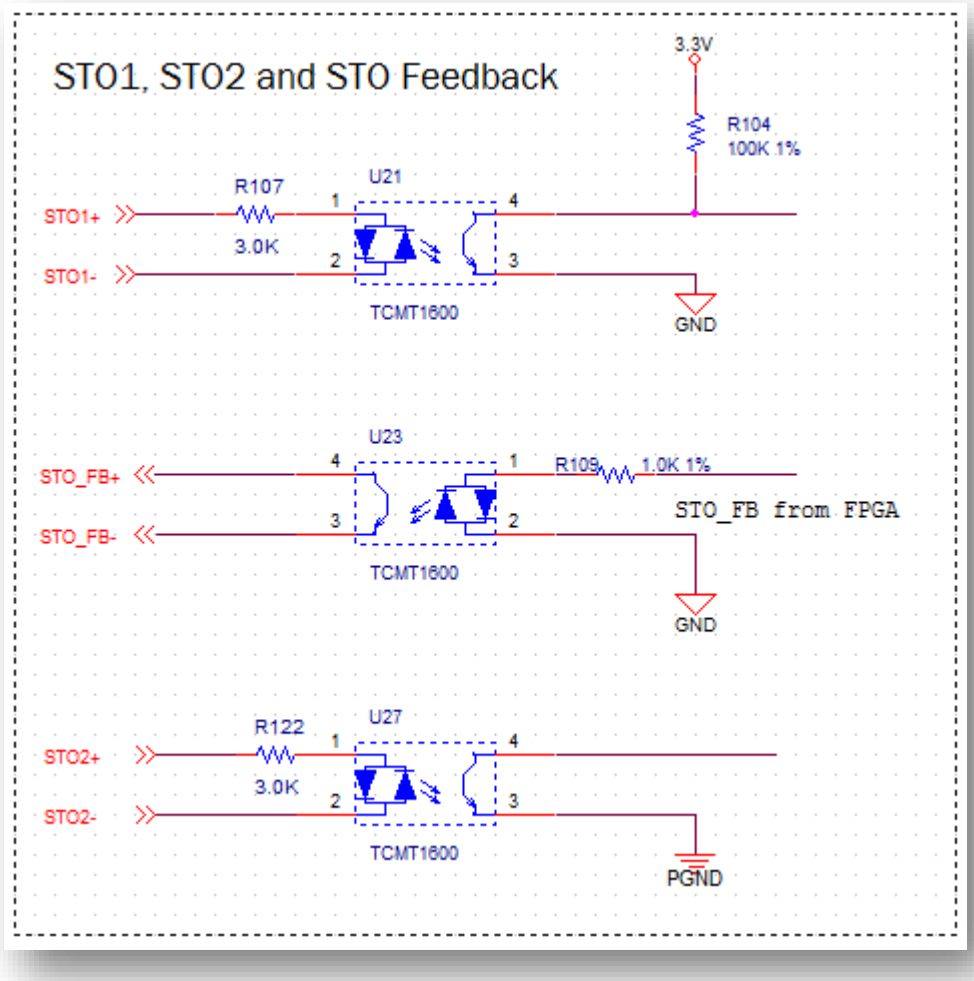
- STO1 and STO2 are completely independent. Each one of them disables the power to the motor in a different way.
- Both STO1 and STO2 disable the power to the motor by hardware circuitry, without any software intervention.
- The circuitry, logic and redundancy of the STO implementation were done according to safety standards. Yet, the design is to be tested and formally approved for the industry standard.
- The STO1 and STO2 are defined with a positive pin (+) and a negative pin (-). However (refer to the electrical interfaces described below) the opto coupler at the STO input (as for all other discrete, isolated inputs of the AG300) is equipped with two input diodes, enabling operation at "positive" or "negative" input voltage. The input is actually activated by (enough) current at one of the input diodes, independently of the current direct. This enables NPN or PNP connection to the STO inputs (each one of them independently!).
- The STO protection logic is designed so that the STO inputs (both of them) must be powered in order to enable motor operation. Leaving an STO input disconnected will prevent motor operation. This logic is required in order to ensure that a disconnected safety cable will be considered by the control unit as an unsafe situation. When (enough)

current is driven through an STO input, the state of this input is "safe". When no (not enough) current is driven through an STO input, the state of this input is "unsafe".

- The two STO inputs must be at "safe" state in order to enable motor operation.

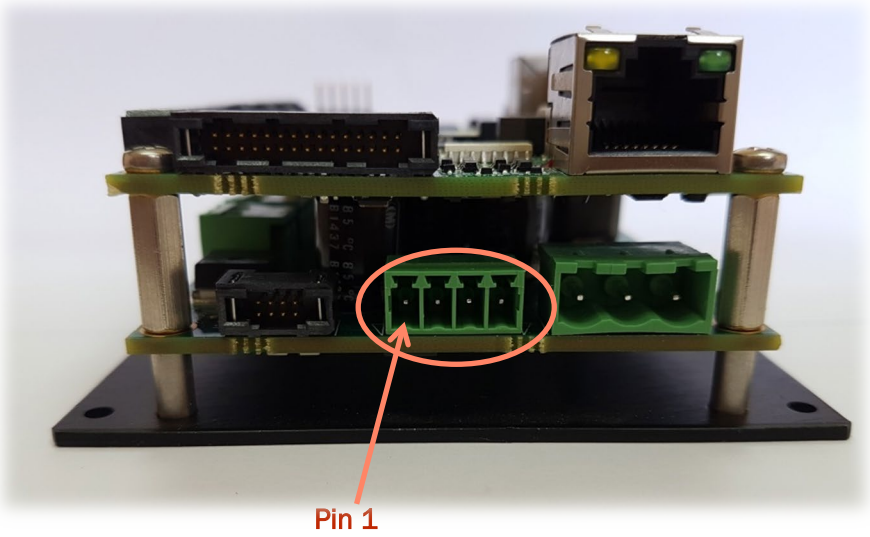
- Both STO1 and STO2, although acting on the drive hardware directly, are also sensed by the controller software. The controller software is generating a feedback signal to the user (STO_FB) which is also an isolated signal. This feedback is generated by the software and is activated in case a least one of STO1 or STO2 signals unsafe situation.

Electrical interfaces – STO:



- The electrical characteristics of the STO1 and STO2 inputs are identical to those of the discrete, isolated inputs of the controller. Refer to the chapter about J9 above.

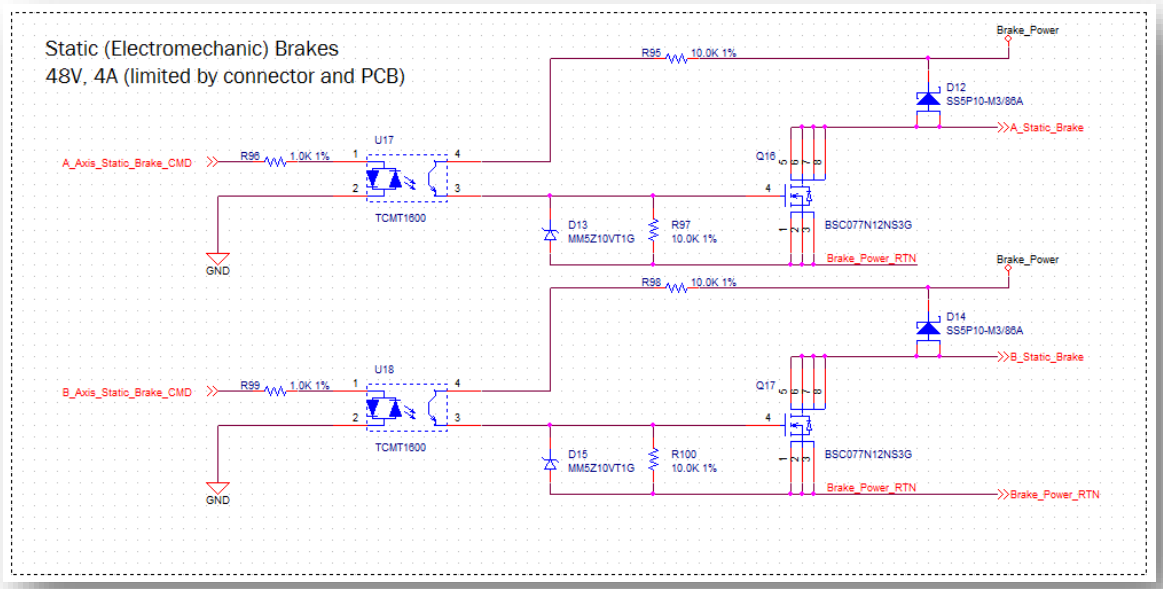
Amplifier – J24 - Static brakes



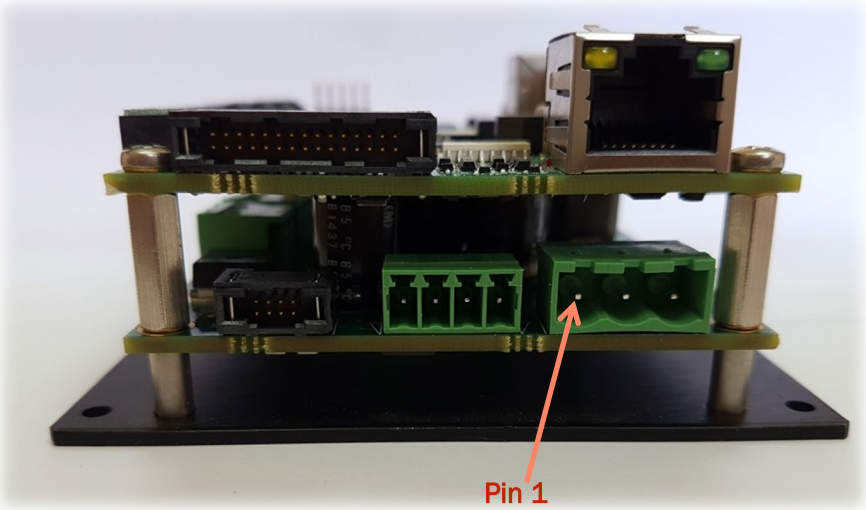
Manufacturer: DEGSON (Phoenix compatible)
P/N (product side): 15EDGRC3.504P1400AH
Pitch: 3.5mm

Pin #	Name	Type	Description
1	Brake_Power	PWR – IN	Power supply for the brake isolated circuits in the controller. Up to 48vDC.
2	A_Static_Brake	PWR	Static brake output for motor A. Open-drain output with built-in flyback diode to the Brake_Power for direct connection into inductive load. Up to 4A operation.
3	B_Static_Brake	PWR	Static brake output for motor B. Open-drain output with built-in flyback diode to the Brake_Power for direct connection into inductive load. Up to 4A operation.
4	Brake_Power_RTN	PWR	Return pin for the Brake_Power.

Electrical interfaces – static brakes:


Static (Electromechanic) Brakes
48V, 4A (limited by connector and PCB)
Brake_Power
R95 10.0K 1%
D12
SS5P10-M3/86A
A_Static_Brake
A_Axis_Static_Brake_CMD
R96 1.0K 1%
U17
TCMT1600
Q16
BSC077N12NS3G
D13
MM5Z10VT1G
R97
10.0K 1%
Brake_Power_RTN
GND
R98 10.0K 1%
D14
SS5P10-M3/86A
B_Static_Brake
B_Axis_Static_Brake_CMD
R99 1.0K 1%
U18
TCMT1600
Q17
BSC077N12NS3G
D15
MM5Z10VT1G
R100
10.0K 1%
Brake_Power_RTN

Amplifier – J25 - Regeneration



Manufacturer: DEGSON (Phoenix compatible)
P/N (product side): 2EDGRC5.0803P14H
Pitch: 5.08mm

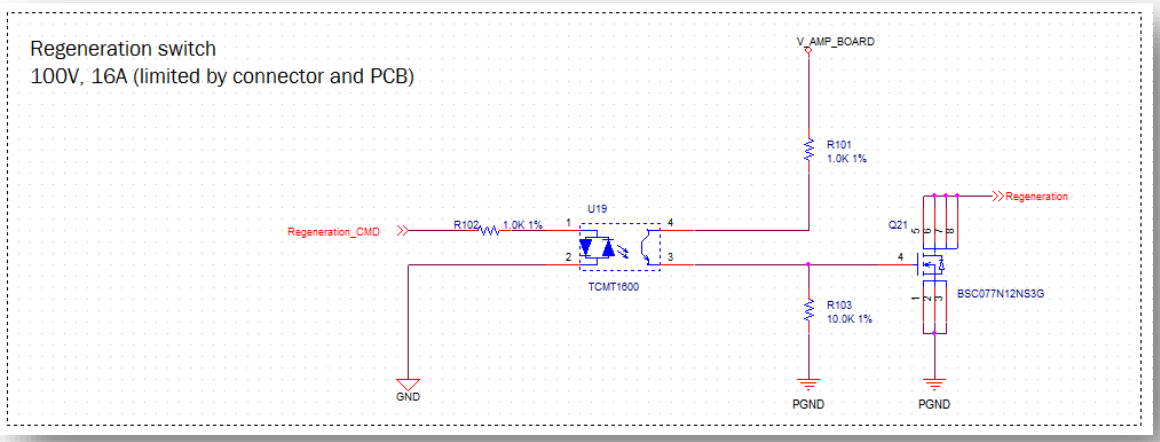
Pin #	Name	Type	Description
1	Internal DC Bus	PWR – OUT	The internal DC Bus power (the same as the main power supply, see J21.
2	Regeneration	PWR	Regeneration pin to be connected to an external regeneration resistor. Limited to 16A. The external regeneration resistor should be connected between this pin (pin 2) and the Internal DC Bus pin (pin 1).
3	Power GND	PWR	The return line for VIN. Do not connect/use this pin for the regeneration function (it is not required for the Regeneration implementation). In future versions of this product (and in similar products from Agito) the Regeneration connector will be a two pins connector and this pin will be removed.

Important Notes:

- The regeneration feature, once enabled, is active at all times, independently of the motor status (enabled/disabled).
- Current will flow in the regeneration resistor depending on the values of RegenOn and RegenOff as set above, and the power supply voltage.
- With the current firmware version, there are no current and/or power protections to protect the regeneration resistor or the internal MOSFET!
- Take care to set the regeneration parameters as suitable for the supply voltage and the external regeneration resistor.
- Plug in the regeneration resistor only after all parameters are set properly and always when the controller power is off.

- Let the regeneration resistor cool down before touching it. Unplug it only when the controller power is off.
- During development, if the supply voltage is to be modified, first disconnect the regeneration resistor and remember to adjust the regeneration parameters as suitable for the new supply voltage, before connecting again the regeneration resistor.
- We recommend considering external protections (such as PTC) to protect the regeneration resistor.
- Future firmware versions will include built in protection of the regeneration resistor's power."

Electrical interfaces - Regeneration:



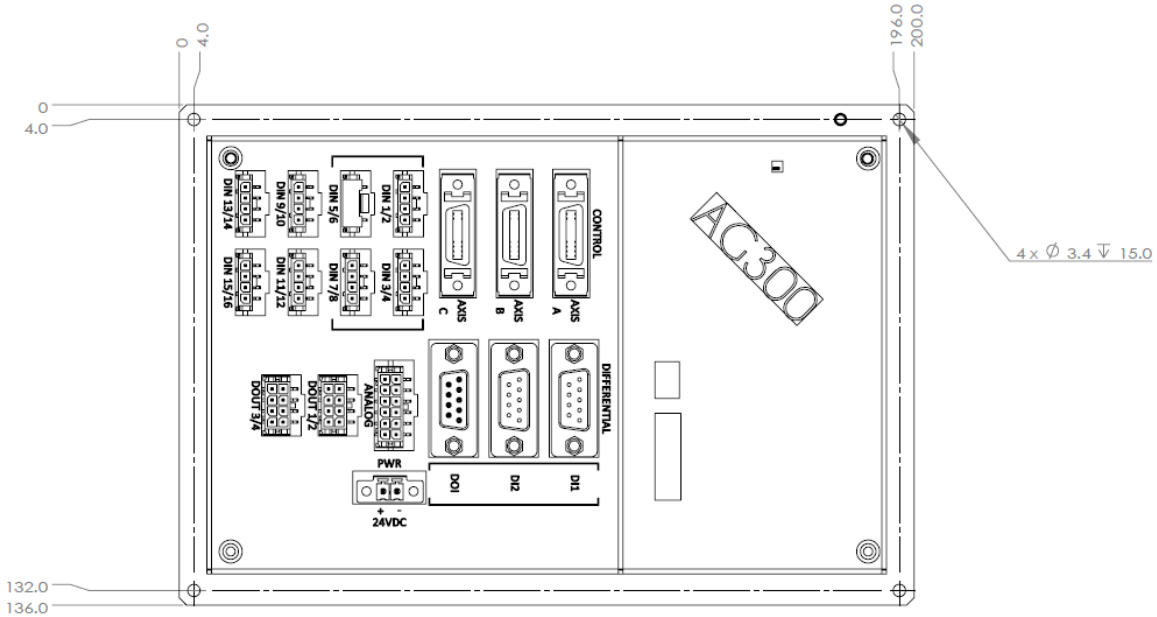
Dimensions

This chapter provides the mechanical dimensions of the controller and of the integrated control unit.

> Note – Metal base:
>
> Both the controller board as a standalone product and the integrated control unit (controller + amplifier boards) are supplied with a metal base, for easy mounting, for protection of the back of the product and for chassis connection.
>
> Please consult Agito in case you prefer to use the product without this metal base to reduce its overall dimensions (typically if the product is anyhow assembled on a metal base which is part of the machine).

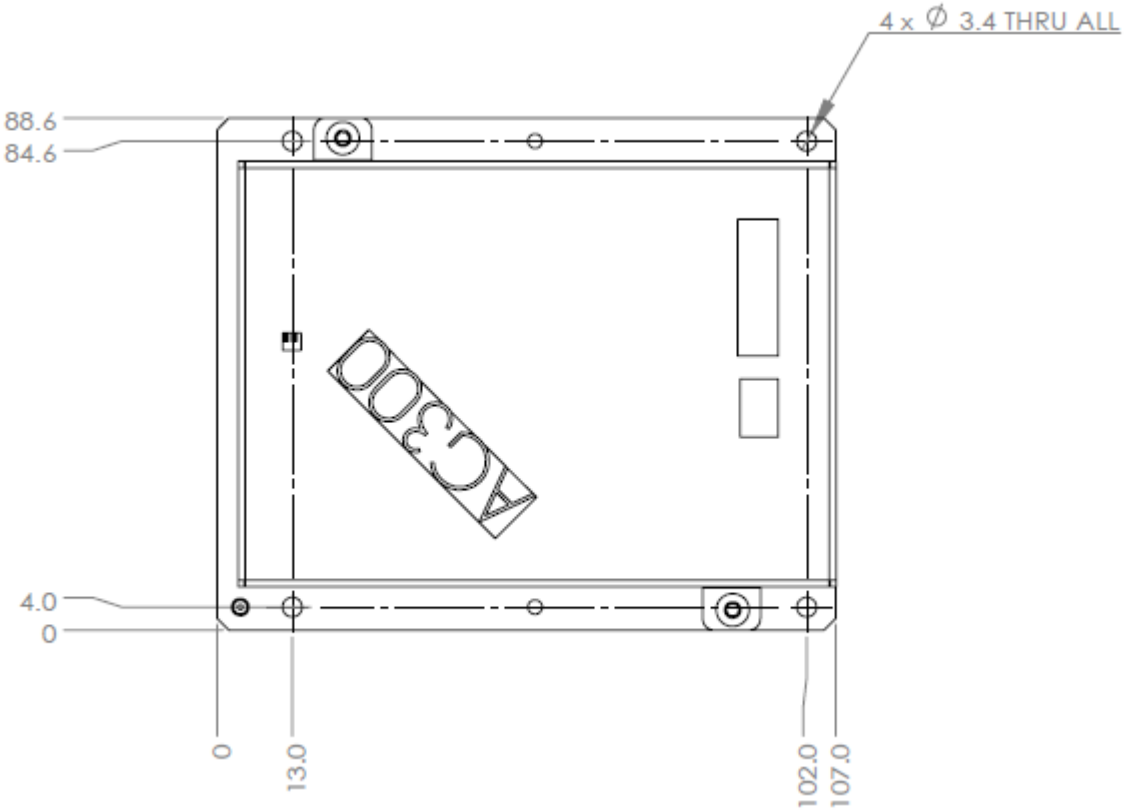
AG300-CTL01-3A-03 standalone controller

The following figures present the dimensions of the AG300-CTL01-3A-03 when supplied as a standalone controller board.



AG300-CTL01 integrated control unit

The following figures present the dimensions of the AG300-CTL01 integrated control unit (controller board plus amplifier board).



Environmental conditions

Requirement	Units	Allowed range
Operational temperature	°C	0 to 50
Storage temperature	°C	-20 to 70
Humidity	%	<90