synchro/resolver amplifier
reference powered 25VA
series 175A300

FEATURES

- **Industry Standard Pin-Out**
- **Transformer & Opto-Isolated**
- **"Locked Rotor" Protection**
- **Thermal Cutoff**
- **Short Ckt & Over-load Protected**
- **Drives Torque Receivers**
- **Drives Multiple CT & CDX Loads**

APPLICATIONS

- **Training Simulators**
- **Fire Control**
- **Retransmission Systems**
- **Remote Indicators**

GENERAL DATA

The series 175A300 is a compact synchro resolver amplifier designed to be bolted to a chassis. The unit operates directly from either 26V, 400Hz or 115V, 60Hz or 400Hz reference power. A +5V power supply is required to drive the input/output logic. Units can be specified to accept 6.81V resolver inputs, 11.8V L-L or 90V L-L synchro inputs and output either 11.8V L-L or 90V L-L synchro signals. All signal inputs and outputs are transformer isolated and the logic inputs/outputs are optically isolated.

The amplifier is powered from the reference excitation and incorporates a pulsating power supply, making this device very efficient. A Disable input allows the output to be turned off when it is not required, providing additional energy savings.

The 175A300 is fully protected providing current limiting, short circuit protection, load transient protection and a thermal cut-off. A "kick circuit" is incorporated that prevents torque receiver hang-up conditions.

THEORY OF OPERATION

The amplifier consists of three main parts: 1) a triple power amplifier, 2) an internal transformer isolated pulsating power supply, and 3) opto-isolated digital controls.

Power Amplifier

The signal inputs to the triple power amplifier are transformer isolated. Either 6.81V resolver signals, 11.8V L-L or 90V L-L synchro are accepted. In the case of resolver signals, a solid-state Scott T transforms the resolver signals to 3-wire synchro signals. These signals are amplified producing a high power 3-wire synchro output. The amplifier has the capability of delivering a continuous 25VA to a synchro load.

The amplifier is fully protected. Current limiting prevents damage from output over-loads or short circuits. If an over-load or short circuit persists for longer than 2 seconds, the output is automatically shut off for approximately 6 seconds, then automatically restored. The cycle will continue until the source of the problem is corrected. This type of protection prevents any chance of the output power transistors going into thermal run-away. The amplifier incorporates thermal protection that disables the output when the internal temperature reaches 125ºC. The output is automatically restored when the temperature drops below 125ºC. If the reference excitation to the amplifier is lost, the 175A300 output appears as an open circuit to the load.

The amplifier also employs a "kick" circuit that prevents hang-up conditions in torque receivers, sometimes referred to as "locked rotor". A hang-up condition can occur in a torque receiver when its rotor is not driven back to null but stalls as some other angle, usually 180º off null. When this stall condition occurs, the torque receiver demands more current than the amplifier can deliver. The amplifier senses this over-current condition and if it persists longer than one second, the "kick" circuit shifts the output angle by 120º for approximately one second to free the rotor hang-up. The "kick" circuit is activated by connecting the CO output to the K input. When driving passive loads such as CT's and CDX's, pins CO and K should be left open.

ELECTRICAL SPECIFICATIONS

Parameter	Value		
Accuracy			
CT & CDX Loads	±3.0 arc-minutes		
TR Loads	±10 arc-minutes		
Signal Input			
Input Isolation	Transformer Isolated		
Synchro Input	Frequency	L-L voltage	Impedance
175A301	360-440Hz	90V	60KΩ min
175A303	57-63Hz	90V	60KΩ min
175A305	360-440Hz	11.8V	60KΩ min
Resolver Input			
175A302	360-440Hz	6.81V	4KΩ min
175A304	57-63Hz	6.81V	4KΩ min
175A306	360-440Hz	6.81V	4KΩ min
Synchro Output Voltage			
175A301-304	90V L-L ±1%		
175A305-306	11.8V L-L ±1%		
Power	25VA		
Control Lines			
Disable (DIS)	Logic "0" enables amplifier output TTL compatible, -2.5mA @ logic "0" Opto-isolated, 1KV breakdown to gnd		
Built in Test (BIT)	Logic "1" indicates output shutdown for either of two reasons: 1. Over-temperature condition 2. Current over-load condition 2 std TTL loads max Opto-isolated, 1KV breakdown to gnd		
Kick Circuit (K and CO)	Jumper Connection @ input connector 1. connected for TR loads 2. unconnected for CT & CDX loads		
Power Supplies			
Reference Input			
Isolation	Transformer, 500V breakdown to gnd		
Frequency	57-63Hz or 360-440Hz		
Voltage	26Vrms or 115Vrms ±10%		
Current			
No Load	130mA max		
Load	1mA per mA of output load		
Logic Supply Voltage			
Voltage	+5V ±5%		
Current	10mA max		
Thermal Characteristics			
Case Temperature Ranges			
Operating	-40º to +85ºC		
Storage	-55º to +125ºC		
Thermal Resistance			
Case to Free Air	2ºC/VA		
Thermal Cutoff	125ºC		
Physical Characteristics			
Size			
60Hz Version	7.4" x 5.1" x 2.6"		
400Hz Version	7.4" x 5.1" x 1.8"		
Weight			
60Hz Version	4 lb.		
400Hz Version	2.5 lb.		

Power Supply

The 175A300 employs a high efficiency pulsating power supply. This power supply produces two unfiltered, full-wave rectified positive and negative voltages. These voltages are always in phase with the amplifier output voltage since the power is derived from synchro reference. These voltage levels will be consistently lower than filtered DC voltages; therefore the power consumed will be much less.

Digital Controls

Two digital control lines are provided, a disable (DIS) input and a Built-in Test (BIT) output. Both lines are optically isolated.

The BIT output when at logic "0" indicates normal operation. When the output is at logic "1", either an over-current or over-temperature condition exists.

The DIS input makes it possible to switch the output on or off. This input can turn the output on only if there is no over-load or over-temperature condition.

DRIVING TORQUE RECEIVERS

The 175A300 is designed to drive single and multiple Torque Receiver (TR) loads. The D/S converter is specified to drive 11.8V TR loads whose Zss > 1.0Ω or 90V TR loads whose Zss > 16Ω.

There are some general considerations when driving TR's with the 175A300. Since both the 175A300 and TR are power sources that are connected together opposing each other, removal of the reference excitation to either will cause very large circulating currents in the stator lines. Theoretically, a TR represents an infinite load impedance to the 175A300 output when at "null", TR shaft angle equals 175A300 angle. In actual practice, the effective load impedance at "null" will be reduced by the effects of two variables: 1)Transformation ratio differences between the two devices, and 2) Reference to stator phase shift differences between the two devices. These effects give rise to a static VA requirement from the 175A300.

The 175A300 is designed to greatly minimize these effects and the static VA never exceeds 7.5VA when driving TR loads of specified Zss. Even under worse static VA conditions, the 175A300 has enough additional VA capability to produce a torque gradient at the TR.

In any torque synchro system there is a false null 180º opposed from the true null. If the 175A300 angle and the TR shaft angle are 180º opposed, the 175A300 is called upon to drive the Zss of the TR, causing maximum current and minimum "pull-out torque", the TR shaft could stall at this false null because of current limiting. This condition is known as "locked rotor". To prevent "locked rotor", the 175A300 incorporates a "kick" circuit that senses for over-current conditions. After a few seconds of an over-current condition, the 175A300 output is shifted 120º for a few seconds, establishing a torque gradient to drive the TR shaft away from the false null. The "kick" circuit is activated by connecting the (CO) pin to the (KICK) pin.

DRIVING CT AND CDX LOADS

When driving CT and CDX loads, the 175A300 must have enough steady power capability to drive the Zso of the load. Generally a CT will be lightly loaded and the following equation can be used to calculate their VA requirement:

$$VA = \frac{.866V^2}{Zso}$$

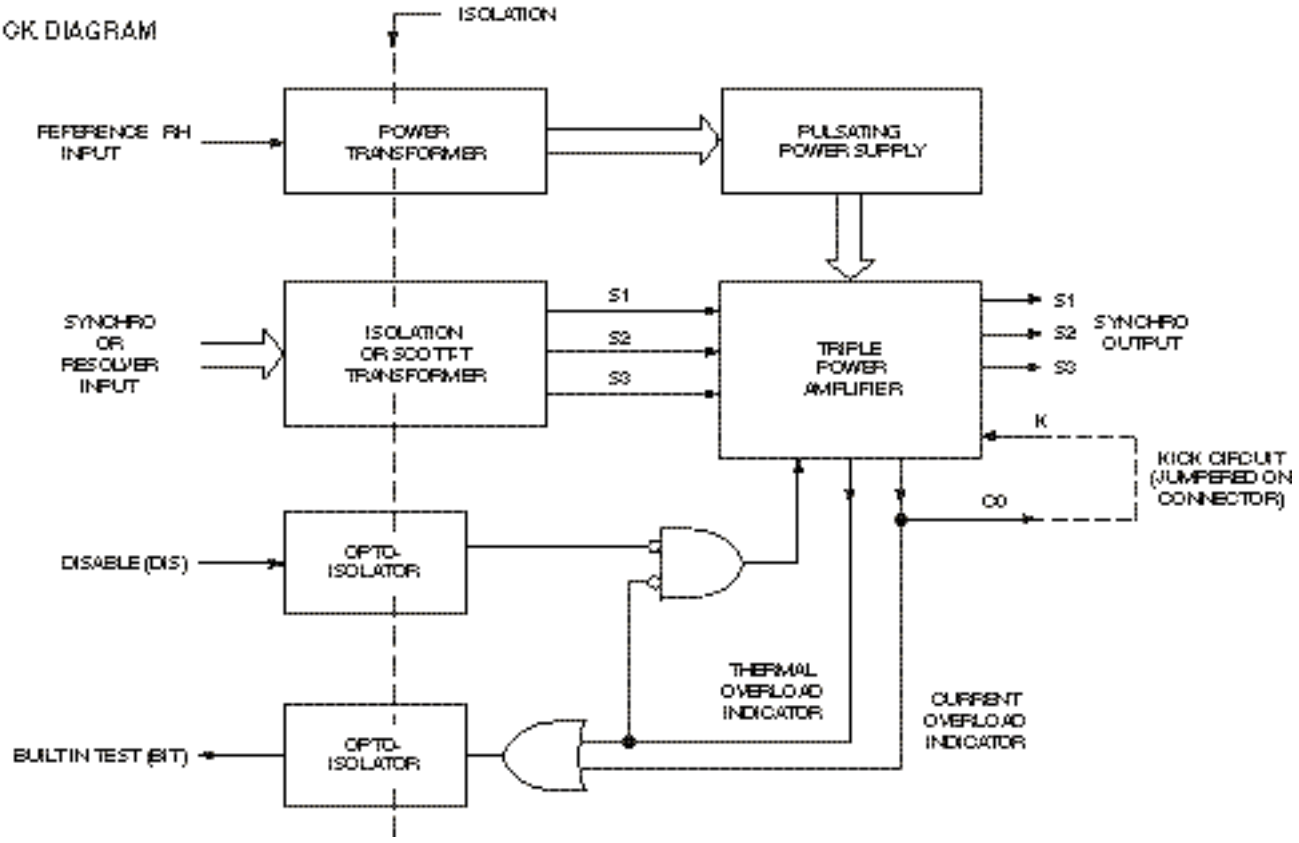
Where : V = primary stator L-L voltage
Zso = stator input impedance with the rotor open

In the case of a CDX load, its outputs are usually connected to a CT. Therefore, when computing the VA requirement, the CT must also be taken into account as follows:

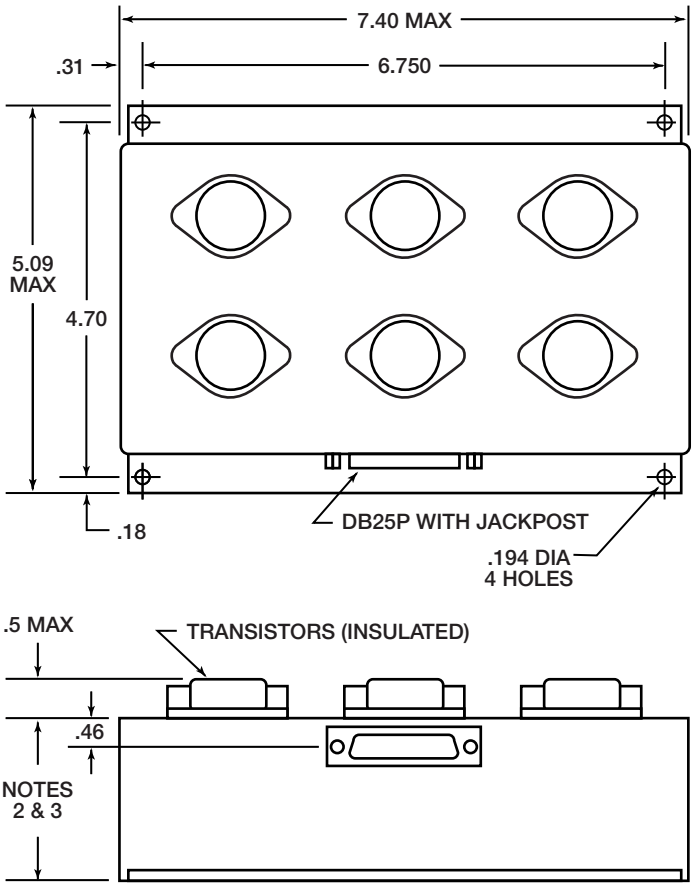
$$VA = \frac{.866V^2 \times (Zso \times Zso')}{Zso + Zso'}$$

Where: Zso = CT stator input impedance
Zso' = CDX stator input impedance
V = maximum stator L-L voltage

BLOCK DIAGRAM



MECHANICAL OUTLINE



NOTES:
1. Dimensions are in inches.
2. 400 Hz models are 1.34 in. max.
3. 60 Hz models are 2.12 in. max.

PIN INTERCONNECTING DATA

PIN	FUNCTION	PIN	FUNCTION
1	+5V	14	DIS IN
2	BIT OUT	15	NC
3	NC	16	GND
4	S1 OUT	17	S3 OUT
5	TP	18	CO
6	K	19	NC
7	TP	20	TP
8	TP	21	S2 OUT
9	S1 IN	22	NC
10	S3 IN	23	RH
11	S4 IN	24	RL
12	S2 IN	25	NC
13	TP		

NOTES:
1. S4 for resolver input version only.
2. NC means no connection is made to this pin internally.
3. TP are test points intended for factory use only.

ORDERING INFORMATION

175A SUFFIX	INPUT TYPE	INPUT VOLTAGE	FREQUENCY	OUTPUT VOLTAGE
301	SYNC	90V	400Hz	90V
302	RSVR	6.81V	400Hz	90V
303	SYNC	90V	60Hz	90V
304	RSVR	6.81V	60Hz	90V
305	SYNC	11.8V	400Hz	11.8V
306	RSVR	6.81V	400Hz	11.8V

NOTES:
1. All units provide 25VA synchro output
2. All units supplied with mating connector