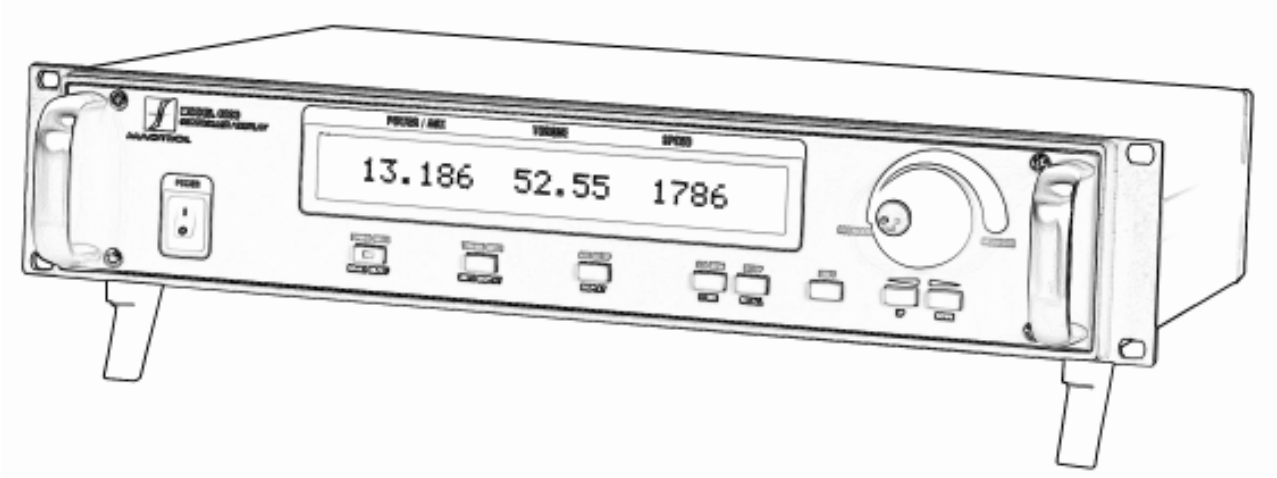
MAGTROL

Model 6200

Dynamometer Controller/Readout



User's Manual

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Manufacturers of:

Motor Test Equipment

◆

Hysteresis Brakes and Clutches

Safety Notes

WARNING

1. Make sure that all Magtrol dynamometers and electronic products are earth-grounded, to ensure personal safety and proper operation.

2. Check line voltage before operating the 6200.

3. Make sure that dynamometers and motors under test are equipped with appropriate safety guards.

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Table of Contents

1 - Introduction

ABOUT THIS MANUAL

This manual contains information about the 6200 Controller/Readout and procedures for optimal use. To obtain the best results from your unit, please follow the procedures for operation.

SHIPPING

Your 6200 was packaged carefully for shipping. Please notify your carrier and Magtrol Customer Service if you believe your unit was damaged in shipping.

UNPACKING YOUR 6200

1. Save all shipping cartons and packaging material until you inspect the 6200.
2. Inspect the 6200 for any evidence of damage in shipping.
3. Make sure the carton contains the following:
   - 6200 Controller/Readout
   - Line cord
   - User's Manual for the 6200
   - Calibration certificate

ABOUT THE MODEL 6200 CONTROLLER/ READOUT

Magtrol's Model 6200 Controller/Readout is current regulated power supply with vacuum fluorescent display for Torque, Speed, and Mechanical Power. The 6200 is designed to work with all Magtrol load cell dynamometers, including the following dynamometer models:

HD-100	HD-510	HD-800	ED-715
HD-106	HD-700	HD-805	ED-815
HD-400	HD-705	HD-810	HTD-100
HD-500	HD-710	HD-815	HTD-200
HD-505	HD-715	HD-825	HTD-300

FEATURES

High quality, easy to read display
Vacuum fluorescent readout with 0.36" (9.1 mm) high digits.

High-speed data acquisition
120 torque and speed readings per second via IEEE (GPIB) bus.

Pass/Fail testing
Upper and lower limits are programmable for torque, speed, and auxiliary input.

Current regulated supply
Provides up to 1 Amp output.

Internal data storage
Nonvolatile memory of up to 100 data points.

Dynamometer overload protection
Maximum power limit can be programmed to shut down if exceeded.

Two standard computer interfaces
RS-232 and IEEE-488.

Additional analog input
Accepts any ± 5 VDC transducer.

Many torque measurement options
Includes English, metric, and SI torque readings as standard.

Closed box calibration of torque and auxiliary input
Eliminates need to open box for adjustments.

The 6200 is designed to work with any personal computer using an IEEE-488 or an RS-232 interface, or as a stand-alone unit. In a computer-controlled environment, the 6200 provides the following motor testing capabilities:

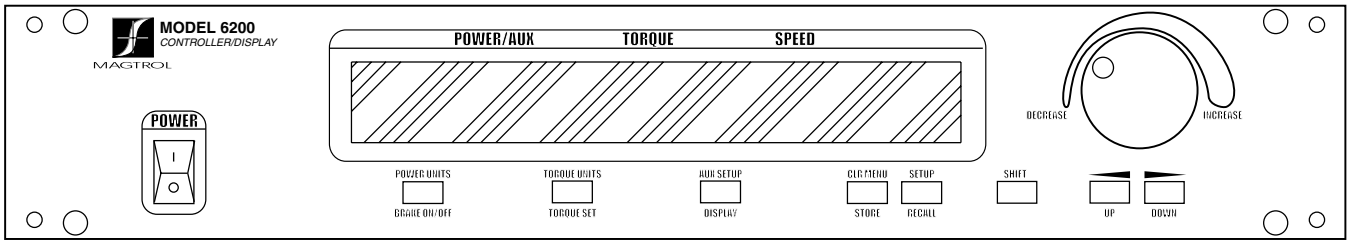
- Current regulated control of dynamometer brake for open-loop testing
- Torque (Q) and Speed (N) data acquisition at a rate of up to 120 readings per second.

SPECIFICATIONS

Dimensions	19" W x 13.8" D x 3.5" H
Weight	16.5 lb
Operating Temperature	18°C to 25°C
Relative Humidity	< 80%
Accuracy	Speed: 0.01% of reading from 10 RPM to 100,000 RPM Torque: 0.2% of range (± 2 V) Aux: 0.1% of range (± 5 V)
Temperature Coefficient	0.001% of range/°C
Aux. Input	± 5 VDC
Ctrl Out	0-3 VDC
Accessory Torque/Speed Output	Torque: ± 2 VDC Speed: 60 TTL pulses/rev, 50% duty cycle
Fuses (5 x 20mm)	Brake: 1.25A UL/CSA 250V SB 1A IEC 250V T Power (120V): 800mA UL/CSA 250V SB Power (240V): 315mA IEC 250V T
Power Requirements	75 VA
Voltage Requirements	120/240V 60/50 Hz
Maximum Speed	99,999 RPM
Maximum Torque	2000 units
Maximum Compliance Voltage	45 VDC

FRONT PANEL

Figure 1. Front Panel



The front panel provides a power switch, eight control buttons, a Decrease/Increase Dial, and Vacuum Fluorescent Display (VFD).

The front panel controls and buttons, from left to right, are:

- Power switch
- Five double-function control buttons:

Primary Function	Secondary Function
BRAKE ON/OFF	POWER UNITS
UNITS DISPLAY	TORQUE UNITS
DISPLAY	AUX SETUP
STORE	CLR MEM
RECALL	SETUP

- Three single-function control buttons:
  - SHIFT (to enable secondary functions printed in blue above control buttons)
  - Up/left arrow ◄ (scroll up, increase magnitude)
  - Down/right arrow ► (scroll down, decrease magnitude)
- Decrease/Increase Dial

NOTE: Refer to the table, "Front Panel Controls and Buttons" on the following page for further explanation of button features and use.

Enabling Secondary Functions

To enable the secondary function of the double-function control buttons:

1. Press the blue SHIFT button and release it. (The word SHIFT appears in the display)
2. Press a control button to enable the function shown in blue letters above the control button:

   POWER UNITS, TORQUE UNITS, AUX SETUP, CLR MEM, or SETUP.
3. Press the SHIFT button again to exit the secondary function.

Vacuum Fluorescent Display (VFD)

The VFD provides information about the control functions, the motor under test, and an auxiliary input device (if connected). The displays, from left to right, are:

- POWER (expressed in horsepower or watts)/ AUX INPUT
- TORQUE
- SPEED
- Memory Indicator

The 6200 is shipped with the Contrast setting at zero (lowest) in order to prolong display life. If it is necessary to increase the contrast for improved readability, use the lowest possible setting to achieve that result. Using a setting higher than necessary may cause display segments to burn-in over a period of time, resulting in uneven illumination from segment to segment.

Displaying Desired Information

Local control:

1. Press SHIFT and release; then press POWER UNITS to see UNITS displayed.
2. Press UP ◄ or DOWN ► to scroll through available choices.
3. Press SHIFT to exit.
4. Press SHIFT and release; then press TORQUE UNITS to see UNITS displayed.
5. Press UP ◄ or DOWN ► to scroll through options for units.
6. Press SHIFT to exit.
7. Press RECALL to view memory contents; last in = first out.
8. Press SHIFT to exit.

Remote control:

Refer to "6200 Command Set" in *Chapter 4 - The 6200 with a PC* for a list of commands recognized by the 6200.

Auxiliary Input:

1. Press SHIFT and release; then press AUX SETUP.
2. Rotate Decrease/Increase Dial to select scale.
3. Press SHIFT to exit.

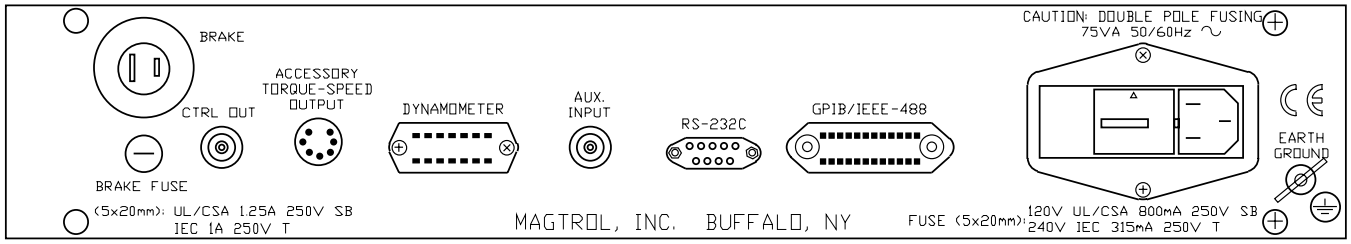
Front Panel Controls and Buttons

Controls/Single Function Buttons	Double-Function Buttons	To Use	Function
POWER		Press I to turn power ON Press O to turn power OFF	Turns power ON or OFF.
	POWER UNITS	Press SHIFT and release; then press this button	Sets power display to WATTS, HP or AUX input.
	BRAKE ON/OFF	Press this button	Toggles brake OFF or ON.
	TORQUE UNITS	Press SHIFT and release; then press this button	Enables you to set desired unit of measure. Press UP ◀ or DOWN ▶ button to see options. Press SHIFT to enable option.
	UNITS DISPLAY	Press this button	Shows power units, torque units and percent of full scale current output.
	AUX SETUP	Press SHIFT and release; then press this button	Enables you to set the scaling of the auxiliary input.
	DISPLAY	Press this button	When in the PASS/FAIL mode, shows actual value of parameter.
	CLR MEM	Press SHIFT and release; then press this button	Clears the data memory. Resets next memory location to 0.
	STORE	Press this button	Stores data into next available memory location.
	SETUP	Press SHIFT and release; then press this button	Enables user to select SYSTEM, PASS/FAIL, and I/O menus.
	RECALL	Press this button	Displays memory contents beginning at last stored value.
SHIFT		Press this button and release, then press desired control button.	Actuates the function written in blue above control button.
UP/◀		Press	Increases magnitude of change when adjusting a numerical value.
DOWN/▶		Press	Decreases magnitude of change when adjusting a numerical value
DECREASE /INCREASE DIAL		Turn clockwise or counterclockwise	Decreases or increases the parameter selected.

REAR PANEL

The rear panel provides connectors and receptacles for connecting to appropriate equipment. Refer to figures 3, 4 and 5 in this chapter for detailed drawings of the brake connector, dynamometer connector and accessory torque/speed output, respectively.

Figure 2. Rear Panel



REAR PANEL FUNCTIONS

The rear panel, from left to right, provides the following functions:

Label	Function
Brake	Connect dynamometer brake cable here
Brake fuse	Contains brake fuse (5 x 20mm) UL/CSA 1.25A 250V SB IEC 1A 250V T
CTRL OUT	Connect to Model 5241 Power Amplifier when using HD-825 Dynamometer
ACCESSORY TORQUE-SPEED OUTPUT	Connect accessory output cable here (optional). **CAUTION** For use with Magtrol Readouts only. Connecting another device to this output may cause equipment failure.
DYNAMOMETER	Connect dynamometer signal cable here
AUX INPUT	Connect auxiliary instrument cable here
RS-232C	Use this socket for RS-232 connector cable
GPIB/IEEE-488	Use this socket for GPIB cable (meets IEEE-488 specifications)
POWER	Attach power cord here
EARTH GROUND	Attach earth ground here

Figure 3. Brake

Figure 4. Dynamometer Connector

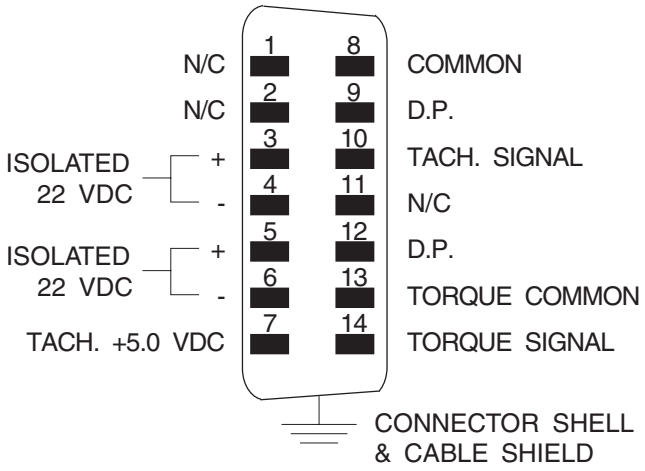
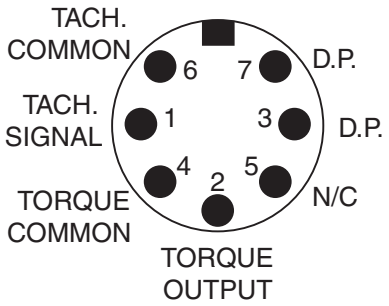


Figure 5. Accessory Torque/Speed Output



CAUTION

For use with Magtrol Readouts only. Connecting another device to this output may cause equipment failure.

2 - Installation

Before installing your 6200, you should become familiar with the front and rear panels, as outlined in *Chapter 1-Introduction*.

WARNING

Make sure the 6200 is earth grounded before starting!

SETTING UNIT FOR LINE VOLTAGE

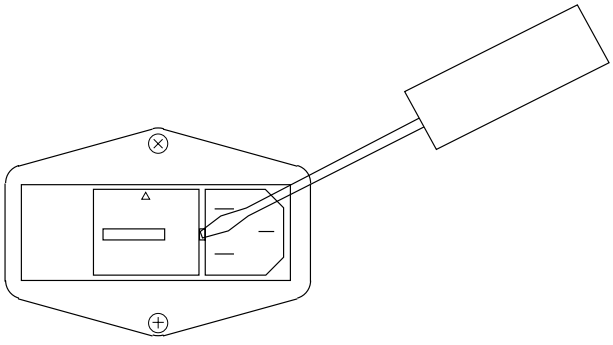
The 6200 will operate with either of the following power sources:

- 120V 50/60 Hz
- 240V 50/60 Hz

1. Find the line cord receptacle on rear panel. The line cord is a detachable NEMA Standard 3 wire.
2. Make sure the selector matches the power source (numbers should match the line voltage).

   If not:
   - Locate the power entry module.
   - Remove the line cord.
   - Insert a screwdriver into the slot and open the cover.
   - Slide the voltage selector so the desired line voltage appears in the window.
   - Install the appropriate fuses for that voltage.

Figure 6. Cover for Voltage Selector, Fuses



CHECKING YOUR 6200

CAUTION

Do not overload or stall the motor. Prolonged overload can cause the motor to overheat.

NOTE: To make sure that the 6200 is operational, a Magtrol dynamometer with a test motor installed must be connected to the 6200. It is not required that the 6200 be connected to a computer.

1. Connect the 6200 to the dynamometer using the following cables:
   - 14-pin signal cable
   - 2-pin brake power cable
2. Turn on 6200 power.

   Desired results:
   - The display panel will show all segments of the VFD (series of rectangles), indicating that the 6200 is executing a self-test routine.
   - Message "MAGTROL 6200" appears.
   - Normal display panel appears.
3. Press the UNITS DISPLAY button and set current output to 0% with Decrease/Increase Dial.
4. Start the test motor.
5. Allow the motor speed to stabilize at its no-load speed for a few seconds.
6. Press the BRAKE ON/OFF button to ON.
7. Turn the Decrease/Increase Dial clockwise.

   Desired results:
   - The torque reading will increase.

     As brake power is applied, load is applied to the motor. The applied torque increases as the Decrease/Increase Dial is turned clockwise. For most motors, loading is indicated by motor speed reduction.

8. Reduce the torque load to zero by turning the Decrease/Increase Dial counterclockwise.

   Desired results:

   - The torque reading will decrease.

9. Press the BRAKE ON/OFF Button to OFF.
10. Turn off power to the test motor.

NOTE: If the desired results did not occur, please see *Chapter 6 - Troubleshooting*.

3 - The 6200 as a Stand-Alone Unit (Local Control)

SETTING DESIRED OPERATING PARAMETERS

NOTE: See *Appendix B: Front Panel/ Display Menu Flow Charts*.

Set Power Display to Desired Units (Watts, Hp, or Aux.)

1. Press and release SHIFT.
2. Press POWER UNITS.
3. Press UP or DOWN to scroll through choices.
4. Press SHIFT to exit.

Set Display to Desired Torque Units

1. Press and release SHIFT.
2. Press TORQUE UNITS.
3. Press UP ◄ or DOWN ► until you see the desired unit of measure.
4. Press SHIFT to exit.

Set Up System Parameters

1. Press and release SHIFT.
2. Press SETUP.
3. Press SHIFT.
4. Press UP ◄ or DOWN ► until you see the desired unit of input torque.
5. Press SHIFT.
6. Press UP ◄ or DOWN ► until selection matches encoder installed on dynamometer. (60-bit = standard)
7. Press SHIFT.
8. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the maximum power setpoint for the dynamometer in use.
9. Press SHIFT to exit.

Set Up Pass/Fail Parameters

1. Press and release SHIFT.
2. Press SETUP.
3. Press the DOWN ► button once.
4. Press SHIFT.
5. Press UP t or DOWN u to turn ON or OFF Torque PASS/FAIL testing.
6. If ON, press SHIFT.
7. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the high limit for Torque.
8. Press SHIFT.
9. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the low limit for Torque.
10. Press SHIFT.
11. Press UP ◄ or DOWN ► to turn ON or OFF Speed PASS/FAIL testing.
12. If ON, press SHIFT.
13. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the high limit for Speed.
14. Press SHIFT.
15. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the low limit for Speed.
16. Press SHIFT.
17. Press UP ◄ or DOWN ► to turn ON or OFF Auxiliary Input PASS/FAIL testing.
18. If ON, press SHIFT.
19. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the high limit for Auxiliary Input.
20. Press SHIFT.
21. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the low limit for Auxiliary Input.
22. Press SHIFT to exit.

SET UP I/O PARAMETERS

1. Press and release SHIFT.
2. Press SETUP.
3. Press the DOWN ► button twice.
4. Press SHIFT.
5. Press UP ◄ or DOWN ► until you see the desired contrast level.
6. Press SHIFT.
7. Press UP ◄ or DOWN ► until you see the desired GPIB address.
8. Press SHIFT.
9. Press UP ◄ or DOWN ► until you see the desired RS-232 baud rate.
10. Press SHIFT to exit.

SETTING DYNAMOMETER LOAD

1. Press the UNITS DISPLAY button.
2. Use the Decrease/Increase Dial to adjust the current output to 0%.
3. Use the BRAKE ON/OFF button to turn the brake ON.
4. Start the motor under test.
5. Use the UP ◄ and DOWN ► buttons and the Decrease/Increase Dial to adjust the loading on the motor.

CAUTION

Do not exceed the capabilities of the dynamometer or the power source in use. Motors draw very large currents when held at locked rotor, and overheating may result. When using open loop current control, induction motors cannot be tested beyond breakdown, except at locked rotor.

USING INTERNAL MEMORY

STORING DATA POINTS

1. Press and release STORE. The VFD will indicate STORE followed by a number. This indicates the memory location that contains the data.
2. Continue pressing STORE at each desired point.

RECALLING DATA POINTS

1. Press and release RECALL. The VFD will indicate RECALL followed by a number. This number indicates the memory location that is being displayed. The order of recalled data is LAST IN = FIRST OUT (LIFO). A "M" also appears to the right of the SPEED display to let the user know that the displayed data is from memory and not real time data.
2. Continue pressing RECALL until all the desired data is retrieved. Once data has been recalled, it is lost from internal memory.

EXITING THE MEMORY MODE

1. Press and release SHIFT.

CLEARING THE MEMORY

1. Press and release SHIFT.
2. Then press CLR MEM.

4 - The 6200 with a PC (Remote Control)

The 6200 can be used with a personal computer to control a dynamometer and to transmit data from motor testing directly to the computer.

ABOUT THE GPIB INTERFACE

(General Purpose Interface Bus)

Magtrol instruments use the GPIB (IEEE-488 Standard) for computer-to-instrument interfacing because:

- The GPIB parallel interface is faster than serial interfaces.
- The GPIB enables testers to access up to 15 instruments on one port. Because typical motor testing requires that at least five separate parameters must be synchronized, a system of easy, fast access to more than one instrument is essential.
- The GPIB has rigid data formatting and hardware standards. These standards help to ensure that all functions will work properly when the hardware and software are installed.

NOTE: The GPIB interface is not standard on most computers. An interface card and driver software must be installed. Magtrol recommends National Instruments Corporation hardware and software.

- An IEEE-488 cable must be installed between the computer and the 6200.

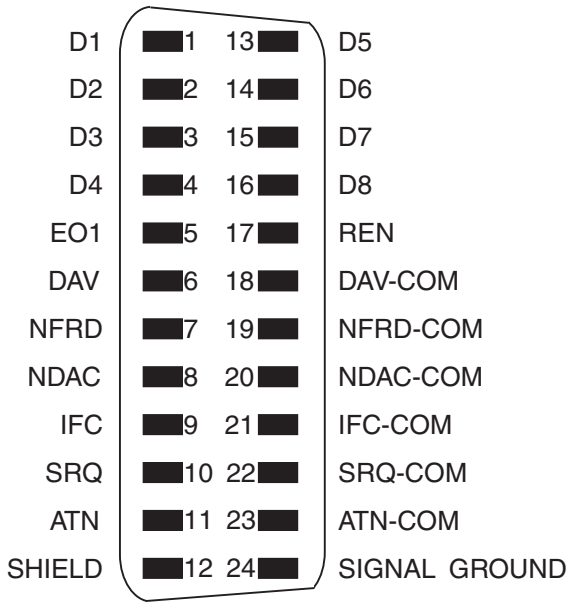
INSTALLING THE GPIB (IEEE-488) CONNECTOR CABLE

CAUTION

Make sure both the computer and the 6200 are turned OFF before installing the GPIB connector cable.

1. Connect one end of a high-quality, double-shielded cable to the 6200 GPIB connector.
2. Connect the other end to the GPIB interface in your PC.

Figure 7. GPIB (IEEE-488) Interface



CHANGING THE GPIB PRIMARY ADDRESS

Each instrument serviced by the GPIB has its own Primary Address code, which enables the computer to obtain readings from the instrument. The factory default setting on the 6200 is 15.

Some PC interfaces can access from one to fifteen 4-bit primary addresses. Other interfaces can access as many as thirty-one 5-bit primary addresses. The 6200 uses the 4-bit format.

1. Press the SHIFT button and release.
2. Press SETUP.
3. Press DOWN ► twice.
4. Press SHIFT twice.
5. Press ◄ or DOWN ► until you see the desired GPIB address.
6. Press SHIFT twice to exit.

CHECKING THE 6200-TO-PC CONNECTION

NOTE: Make sure that the 6200 and its host computer are communicating before acquiring data.

1. Make sure the primary address is set correctly for the 6200.
2. Set the input variable to 15 characters (13 variable characters and the two required data termination characters CR and LF. (See “Programming” in this chapter.)
3. Issue output data command "OD" and read 15 characters according to the instructions for your GPIB interface.

   Desired results:

   - Torque/speed data will be returned

NOTE: If the desired results did not occur, please see *Chapter 6 - Troubleshooting*.

PROGRAMMING

NOTE: Check the manual provided with your software for full instructions.

1. Use the following information to answer the formatting questions asked when installing your GPIB software.
   - All GPIB data acquisition systems requires the use of data termination characters. The 6200 uses the GPIB standard termination characters "Carriage Return (CR)-Line Feed (LF)." Provide them in that order.

CODES FOR CR - LF

	BASIC	HEX	DEC
CR =	CHR$(13)	0D	13
LF =	CHR$(10)	0A	10

2. Set the timeout for at least one second, if you are asked to set a communication fault delay timeout.
   - If the communication fault delay timeout is too short, or if the computer resets the interface too quickly, the host instrument may stop responding.

6200 COMMAND SET

When entering a command code:

1. Type all characters in uppercase ASCII format.
2. End all commands with a CR-LF (hex 0D-0A).
3. Do not string multiple commands together in one line.

The character # represents a floating point numerical value following the command. Leading zeroes are not required.

COMMAND SET FOR 6200

Command Category	Command Code	Function	Explanation
Communications	**H**	Sets high data acquisition rate (120 samples per second)	The Controller/Readout outputs data at 120 S/s (Using an RS-232 interface, the rate is 60 S/s.)
Communications	**L**	Sets low data acquisition rate (3.8 samples per second)	The Controller/Readout outputs data at 3.8 S/s (default rate).
Communications	**OA**	Prompts to return to auxiliary input data string	"Output Auxiliary" prompt to return the value at the AUX INPUT x AUX SCALING factor.
Communications	**OD**	Prompts to return speed-torque-direction data string	"Output Data" prompt to return data string with this format: SxxxxxTxxxxxRcrlf or SxxxxxTxxxxxLcrlf R or L is the shaft direction indicator, as viewed looking at the dynamometer shaft, where: R = right; clockwise (CW) L = left; counterclockwise (CCW) The speed will equal the displayed value and the torque will be in the same units as displayed on the front panel.
Setup	**M1**	Enables front panel controls	Use this command to enable front panel control of most functions.
Setup	**M0**	Locks out front panel controls	Use this command to lock out the front panel controls, so that the Controller/Readout settings can be changed only by using the computer with either the GPIB (IEEE-488) or the RS-232 interface. NOTE: The brake ON/OFF switch on the front panel still functions.
Setup	**R**	Resets as follows: • Manual control ON • Low data acquisition rate • Brake OFF	Use this command to cancel any previous commands. NOTE: These settings are the power-on default settings.
Setup	**UA#**	Sets auxiliary input scaling to #	This command sets the scaling factor for the auxiliary input to # units/volt. The range is 0.0 to 10000.0. Programmed value # is not saved at power down.

Setup	**UE#**	Sets encoder pulse count to #	This command selects the pulse count option for speed transducing. The pulse count defaults to 60-bit if out of range.
			The standard encoder supplied with all Magtrol Load Cell Dynamometers is 60 pulses/revolution. Optional 600 and 6000 pulse encoders are available for low-speed applications.
			Codes for pulse count # are:
			0 = 60-bit
			1 = 600-bit
			2 = 6000-bit
			Programmed value # is not saved at power down.

Command Category	Command Code	Function	Explanation

Setup	**UI#**	Sets dynamometer torque units to #	NOTE: For Hp and watts calculations to be correct, the correct dynamometer torque units must be specified. Values for # are:
			0 = oz.in. 5 = kg.cm.
			1 = oz.ft. 6 = N.mm.
			2 = lb.in. 7 = N.cm.
			3 = lb.ft. 8 = N.m.
			4 = g.cm.
			Torque units default to 0 (oz.in.) if out of range. Programmed value # is not saved at power down.

Setup	**UR#**	Sets readout torque units to #	This command sets the torque unit conversion for the torque readout.
			Values for # are:
			0 = oz.in. 5 = kg.cm.
			1 = oz.ft. 6 = N.mm.
			2 = lb.in. 7 = N.cm.
			3 = lb.ft. 8 = N.m.
			4 = g.cm.
			Torque unit conversion defaults to 0 (oz.in.) if out of range. Programmed value # is not saved at power down.

Misc	**X**	Prompts to return % current output	This command returns the % current value in the format "I##.##". The value will be between 0 (no loading) and 99.99 (full loading).
Misc	**I#**	Sets current output to #	The power supply outputs a fixed value of current. Use any value # between 0 and 99.99%. (99.99% = 1 Amp.)

ACQUIRING SPEED-TORQUE DATA

Speed-torque data is a fixed-length string in ASCII format with a floating point decimal. Use the following string format:

SdddddTdddd.R[cr][lf]

or

SdddddTdddd.L[cr][lf]

where . . .

S = speed in RPM. No leading zeroes are used.

d = decimal digit 0 through 9

T = torque in units selected during setup. The torque value always contains a decimal point.

L = counterclockwise dynamometer shaft rotation (left)

R = clockwise dynamometer shaft rotation (right)

. = decimal point. The decimal point location depends on the specific dynamometer and torque range in use.

NOTE: The [cr] and [lf] characters will not display.

Example:

If a motor is running at 1725 RPM clockwise, with the dynamometer loading the motor to 22.6 oz.in., the 6200 will return:

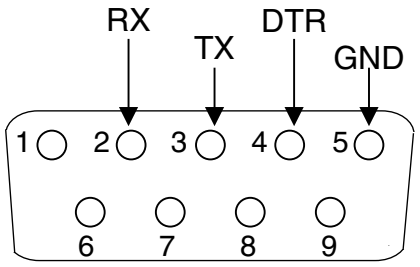
S 1725T22.60R

By manipulating the string, the speed-torque and shaft direction (if required) can be extracted. Then separate numerical variables can be assigned to them for data processing.

SELECTING THE BAUD RATE FOR THE RS-232 INTERFACE

The 6200 communicates with the host computer through a DB-9 interface connector. The connector pin-out is: 2-RX, 3-TX, 4-DTR, 5-GND. No other pins are connected.

Figure 8. Connector Pin-Out



The 6200 is equipped with an RS-232 (serial) interface. To select the baud rate:

1. Press SHIFT and release.
2. Press SETUP button.
3. Press DOWN ► twice.
4. Press SHIFT three times.
5. Press the UP ◄ or DOWN ► buttons to cycle through the following available baud rates:

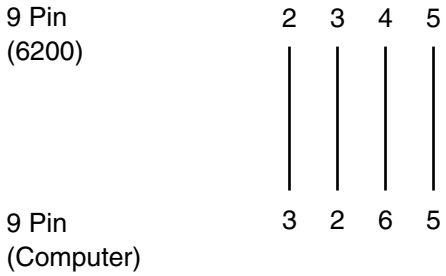
   300 2400 9600
   600 4800 19200
   1200

6. Press SHIFT to Exit

   Other important communication parameters are:

   - No Parity
   - 8 Data Bits
   - 1 Stop Bit

To wire your own serial communications cable, use the following wiring diagram:



A cable may also be purchased from your local electronics store. A Radio Shack #26-152 cable and #26-264 null modem adapter are known to work. The null modem adapter must be used on the computer end of the cable.

5 - Calibration

CLOSED-BOX CALIBRATION

The 6200 features closed-box calibration. The advantage of closed-box calibration is that the user does not have to disassemble the case or make mechanical adjustments. However, the calibration of the Accessory Torque Output must be done internally with Offset and Gain trim pots.

The Torque readout and Auxiliary Input can be calibrated using external reference sources. Correction factors for Offset and Gain are stored in nonvolatile memory. They remain in effect until the user or the calibration house updates them.

The front panel displays the actual values for the ZERO and GAIN correction factors. Record these values before calibration. In the unlikely event of a Controller/ Readout failure, it can re-initialized by pressing and holding the STORE and RECALL buttons while turning the power on. All internal memory and setups will be lost. After re-initializing, reprogram the GAIN and ZERO values into memory.

CALIBRATION SCHEDULE

Calibrate your 6200:

- After any repairs are performed
- At least once a year; more frequently to ensure required accuracy

BASIC CALIBRATION PROCESS

The basic calibration process consists of four procedures which must be performed them in the following order:

1. Initial Procedure
2. Torque Offset and Gain
3. Accessory Torque Output Offset and Gain
4. Auxiliary Input Offset and Gain

To calibrate the 6200, you will need:

- External voltage reference of 0 to 5 Volts DC
- Digital multimeter (DMM) with VDC accuracy of 0.05% or better

INITIAL CALIBRATION PROCEDURE

NOTE: Record the actual correction factors displayed before proceeding with calibration.

1. Allow the 6200 to stabilize in an environment with:
   - An ambient temperature of 18°C to 25°C
   - Relative humidity less than 80%
2. Turn on the 6200.
3. Allow the 6200 to warm up for at least 30 minutes.
4. Enable the calibration mode as follows:
   - Turn instrument power OFF
   - Press in and hold the UP ◄ and DOWN ► arrow buttons simultaneously
   - Turn instrument power ON
5. Continue pressing the UP ◄ and DOWN ► arrow buttons until the display shows the software revision date.
6. Press the SHIFT button once.

NOTE: To exit CALIBRATE mode without making any changes, press the SHIFT button six times.

TORQUE OFFSET AND GAIN

1. Connect the external voltage reference common to Pin 13 of the dynamometer input connector.
2. Connect the external voltage reference high to Pin 14 of the dynamometer input connector.
3. Apply +2.000 VDC.
4. Press the DISPLAY button.
5. Adjust the gain by turning the Decrease/Increase Dial until the displayed voltage equals the reference voltage.

NOTE: The magnitude of change per revolution can be increased by pressing the UP ◄ button or decreased by pressing the DOWN ► button.

6. Apply 0.000 VDC.
7. Press the UNITS DISPLAY button.
8. Adjust the Decrease/Increase Dial until the display indicates 0 mVDC.
9. Repeat steps 3 through 8 to complete this procedure.
10. Press the SHIFT button.
11. Record the T-ZERO correction factor for future reference.
12. Press the SHIFT button.
13. Record the T-GAIN correction factor for future reference.

Accessory Torque Offset and Gain

1. Connect the DMM common to Pin 4 of the Accessory Torque-Speed Output connector.
2. Connect the DMM high to Pin 2 of the Accessory Torque-Speed Output connector
3. Apply 0.000 VDC
4. Adjust R24 (OFFSET) on the circuit board for 0 mVDC on the DMM.
5. Apply +2.000 VDC.
6. Adjust R25 (GAIN) on the circuit board for +2.000 VDC on the DMM.

Auxiliary Input Offset and Gain

1. Press the SHIFT button once. Display indicates AUX INPUT calibration.
2. Connect the external voltage reference to the Auxiliary Input BNC connector.
3. Apply +5.000 VDC.
4. Press the DISPLAY button.
5. Adjust the gain by turning the Decrease/Increase Dial until the displayed voltage equals the reference voltage.

NOTE: The magnitude of change per revolution can be increased by pressing the UP ◄ button or decreased by pressing the DOWN ► button.

6. Apply 0.000 VDC.
7. Press the UNITS DISPLAY button.
8. Adjust the Decrease/Increase Dial until the display indicates 0 mVDC.
9. Repeat steps 3 through 8 to complete this procedure.
10. Press the SHIFT button.
11. Record the A_ZERO correction factor for future reference.
12. Press the SHIFT button.
13. Record the A_GAIN correction factor for future reference.
14. Press the SHIFT button once to return to default display.

Alternate Calibration Procedure

The 6200 can also be calibrated by using a certified dynamometer, calibration beam, and weight instead of an external voltage reference.

NOTE: Magtrol suggests you do NOT use this method. By using the alternate calibration procedure, you are calibrating the 6200 to a specific dynamometer, not to a reference standard. If you connect the 6200 to a different dynamometer, the resulting torque reading may be incorrect.

1. Connect the chosen dynamometer to the 6200 using the 14-pin signal cable and the 2-pin brake cable.
2. Attach the calibration beam to the dynamometer shaft.
3. Enter the calibration mode.
4. Press the BRAKE ON/OFF button ON to apply full loading to the dynamometer.
5. Hang the weight on the calibration beam pin and level the beam.
6. Press the DISPLAY button.
7. Adjust the gain by turning the Decrease/Increase Dial until the displayed voltage equals the reference voltage.

NOTE: The magnitude of change per revolution can be increased by pressing the UP ◄ button or decreased by pressing the DOWN ► button.

8. Remove the weight for ZERO adjustment.
9. Press the UNITS DISPLAY button.
10. Adjust the Increase/Decrease Dial until the display indicates 0 mVDC.

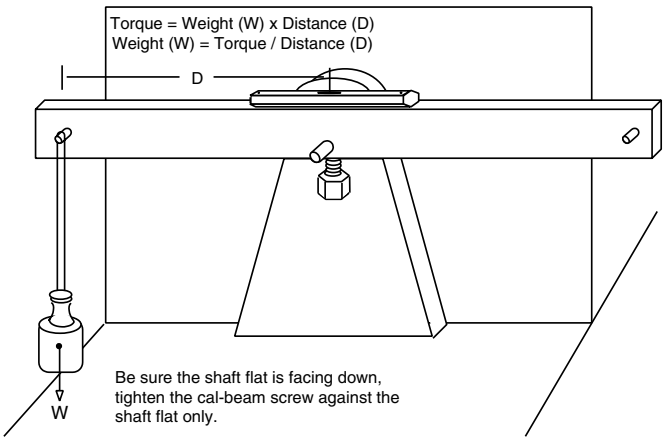
NOTE: The mV output of the dynamometer will be equivalent to the Weight times Distance on the calibration beam, disregarding any decimal point.

Example:

Magtrol's HD-400-6 Dynamometer has a full-scale torque of 40.0 oz.in. The distance from the center of the dynamometer shaft to the pin on the calibration beam is 5 inches. Placing an 8 oz. weight on the pin will produce a torque of 40.0 oz.in. The mV output of the dynamometer will be equivalent to 8 oz. multiplied by 5 inches, yielding an output signal of 400 mV.

11. Repeat steps 5 through 10.
12. After completing calibration:
    - Press the BRAKE ON/OFF button OFF to remove loading from the dynamometer.
13. Remove the calibration beam from the dynamometer shaft.
14. Proceed with your desired motor testing.

Figure 9. Alternative Calibration



6 - Troubleshooting

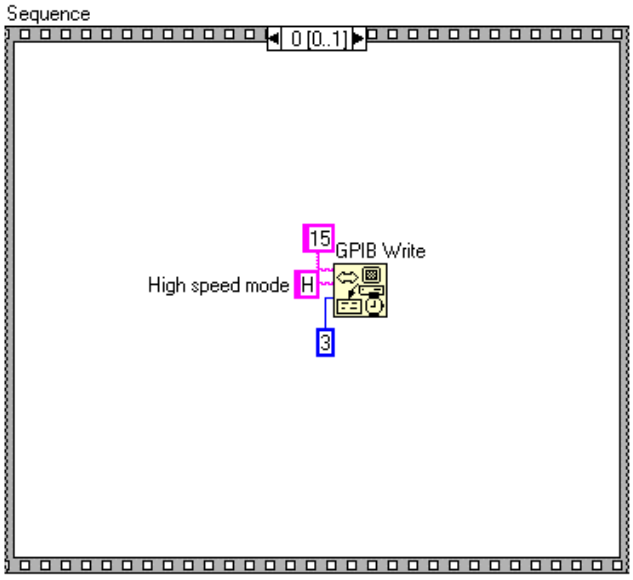
PROBLEM	REASON	SOLUTION
Returned data indicates COMMAND ERROR	Command does not match the unit's programmed set of instructions	Use correct command and format
Mechanical power reads much higher or lower than expected	Torque units are incorrect	Set torque input units to match the specifications on dynamometer nameplate
No GPIB communication	Setup error and/or hardware fault	Check: • GPIB address of Controller/Readout • GPIB cable: should be functioning and attached to Controller/Readout and computer interface card
No RS-232 communication	Setup error and/or hardware fault	Check: • Baud rate of Controller/Readout • Pinout of serial cable • Cable attachment to Controller/Readout and serial interface port of computer
Dynamometer shaft does not turn smoothly when BRAKE is OFF	Salient poles were set up on the rotor by having brake current applied with no shaft rotation	Start the motor and bring up to speed. Press BRAKE button ON. Adjust output current up to a value at least 25% of the maximum torque rating of the dynamometer in use (if possible). Reduce output current to 0.

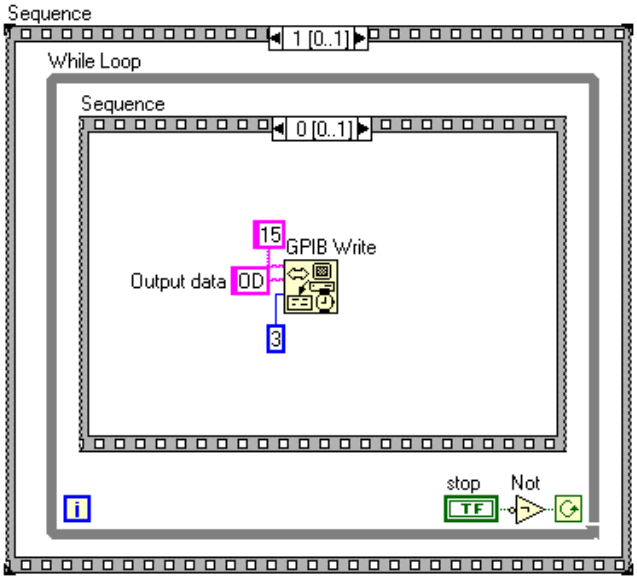
If you require additional assistance, please contact
Magtrol Customer Service at 1-800-828-7844 or 1-716-668-5555

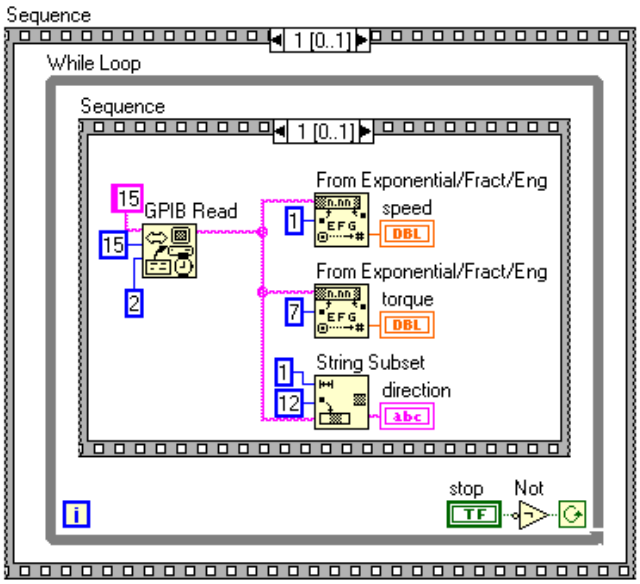
Appendix A: LabVIEW® Programming Examples

Magtrol offers a comprehensive motor-test software program to satisfy most of your programming needs. To order your software, call Magtrol Sales at 1-800-828-7844 or 1-716-668-5555.

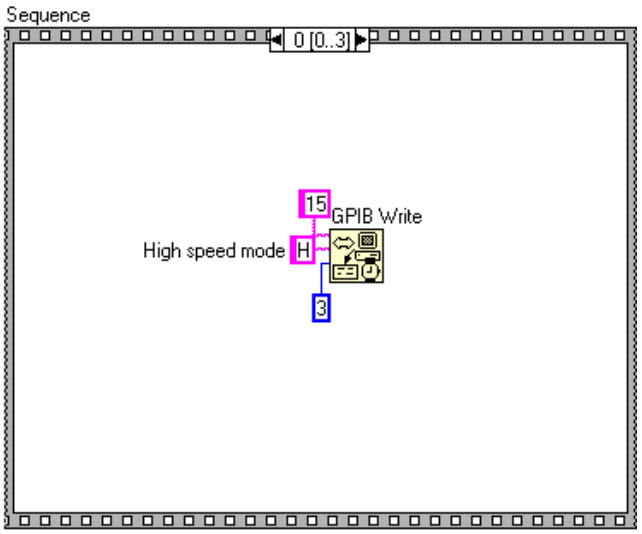
SIMPLE READ

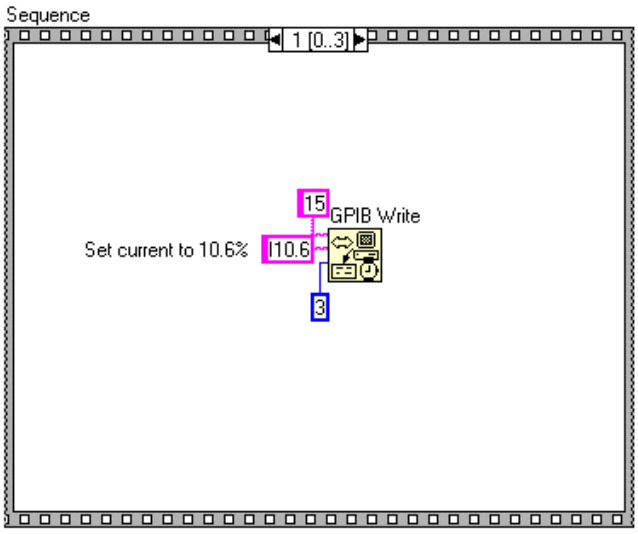


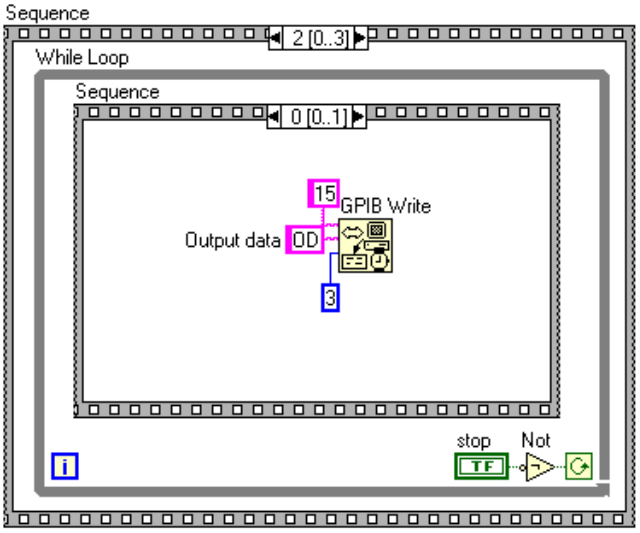


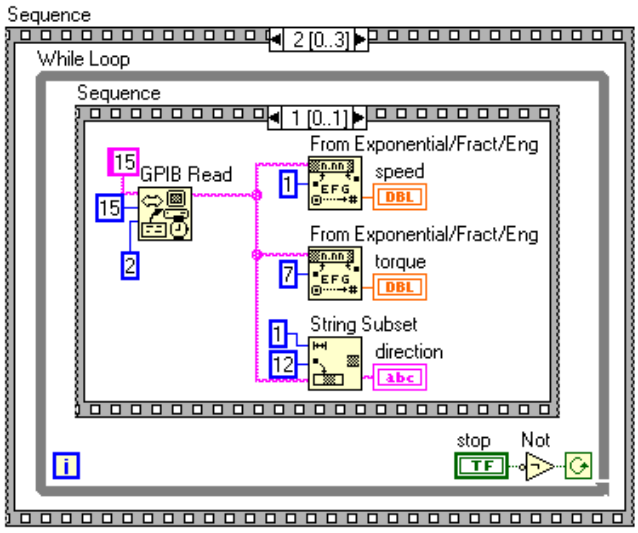


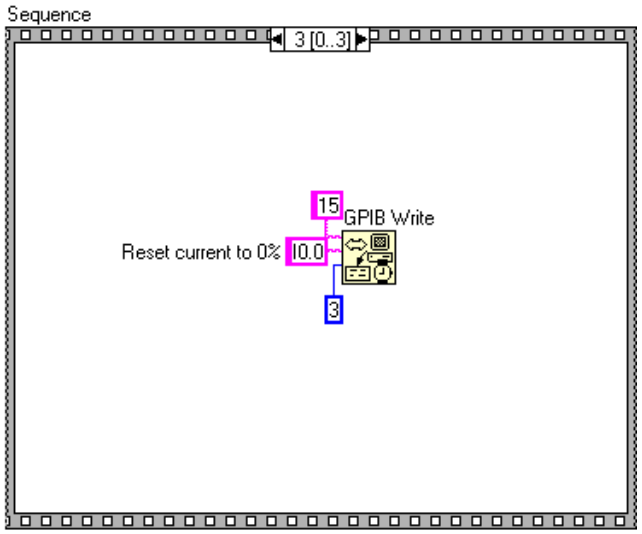
CURRENT STABILIZED





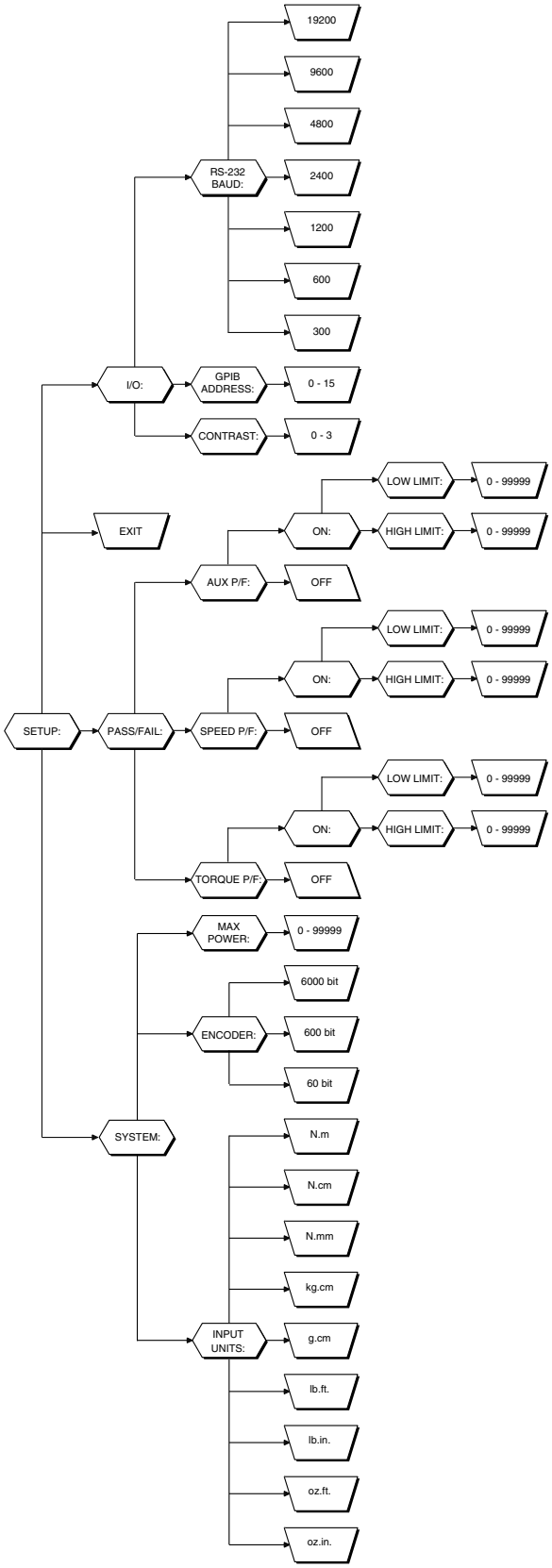




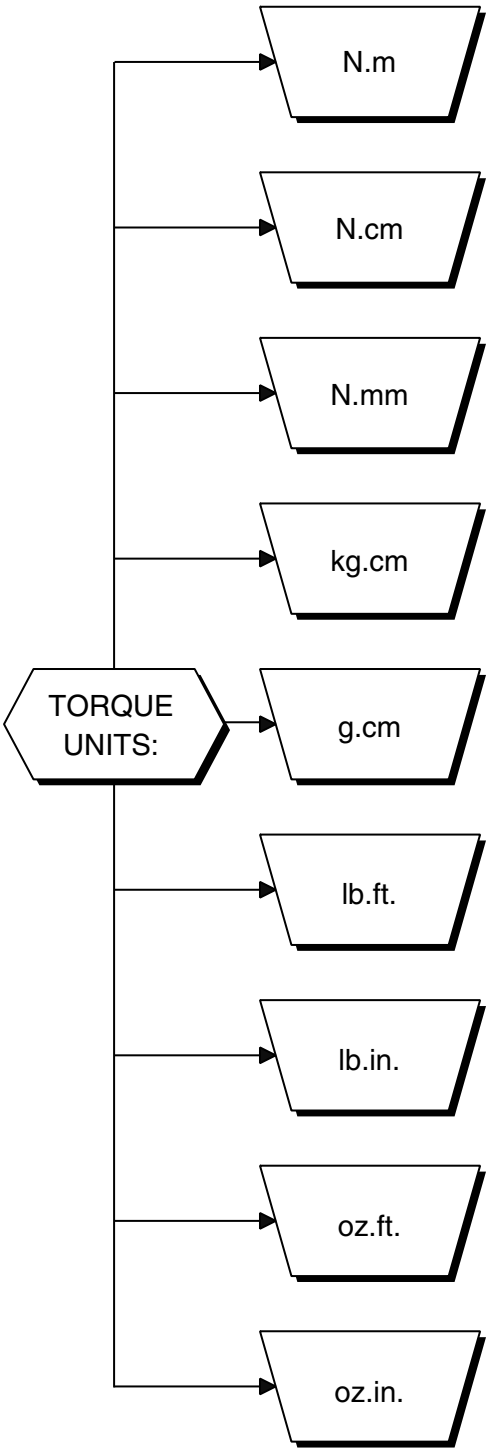


Appendix B: Front Panel/Display Menu Flow Charts

SETUP MENU

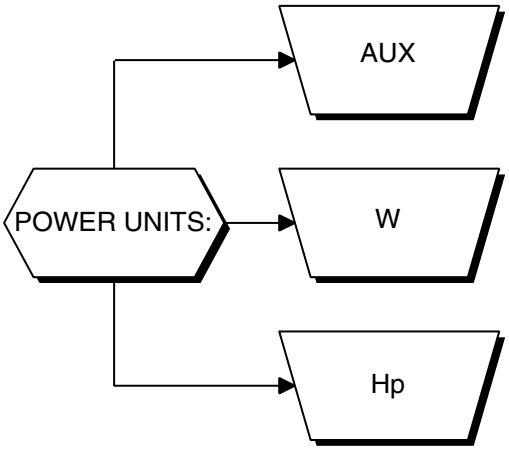


TORQUE UNITS MENU



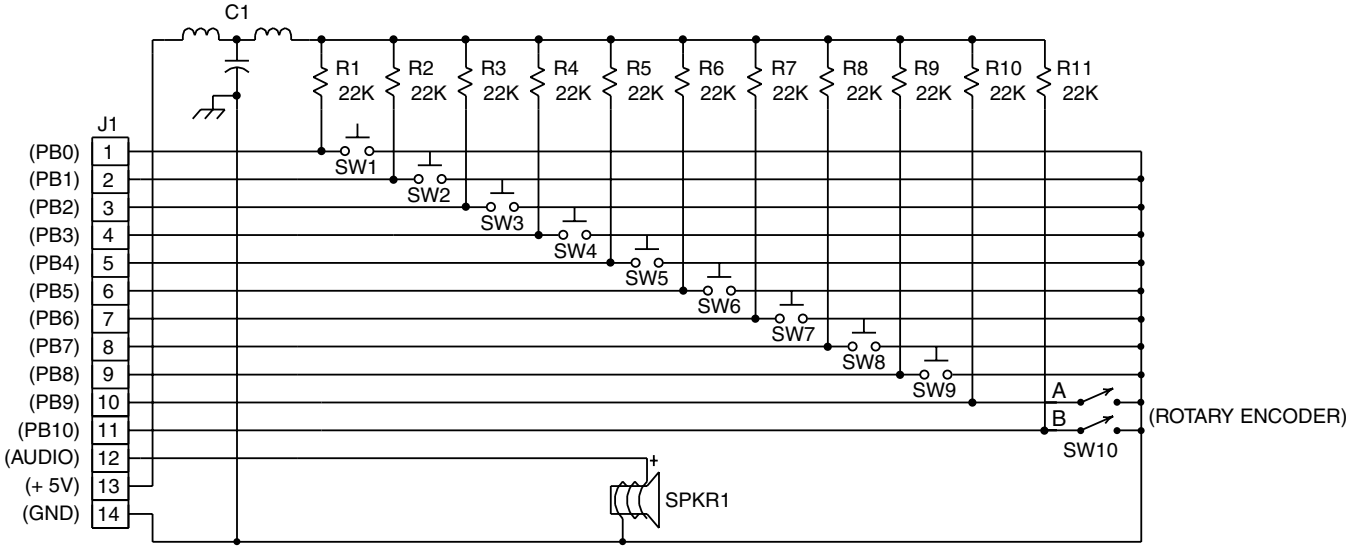
AUX SETUP MENU

POWER UNITS MENU

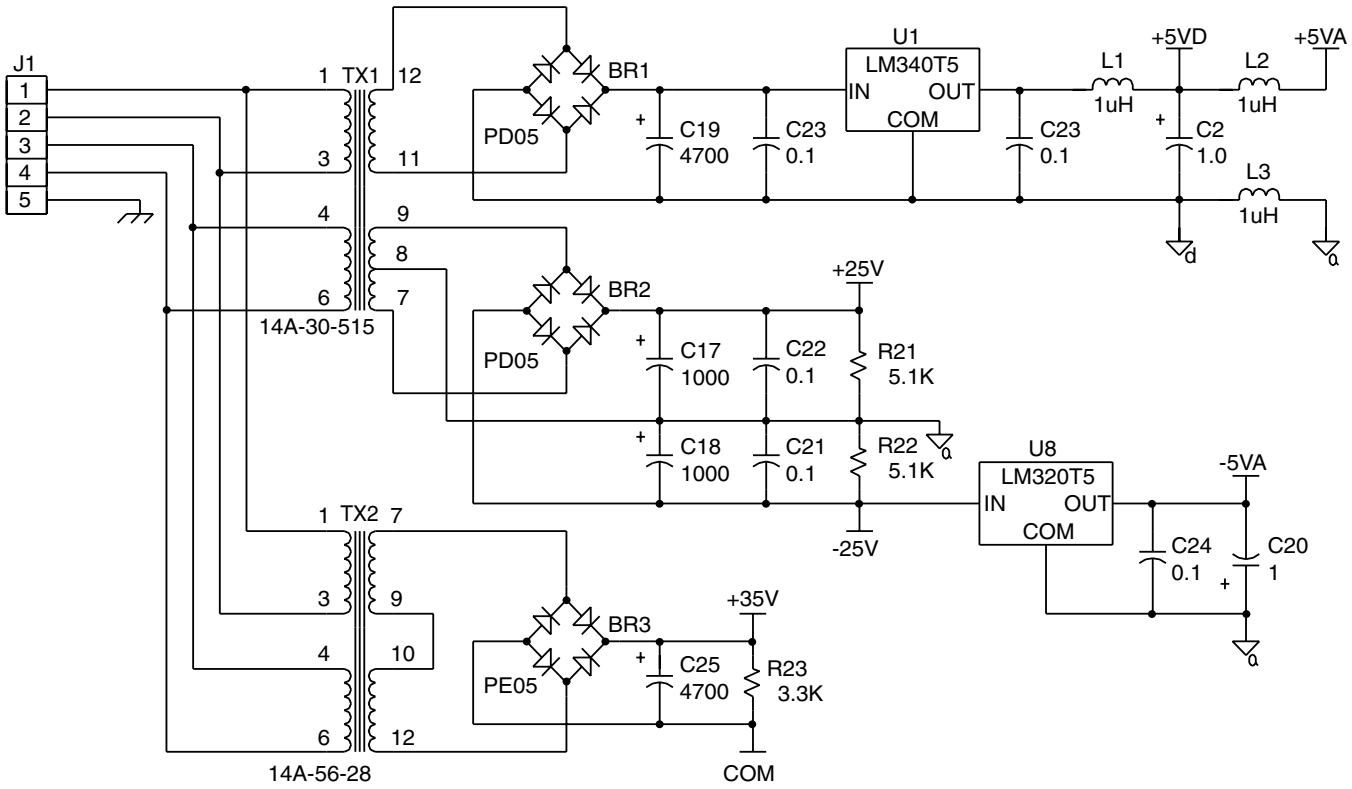


Appendix C: Schematics

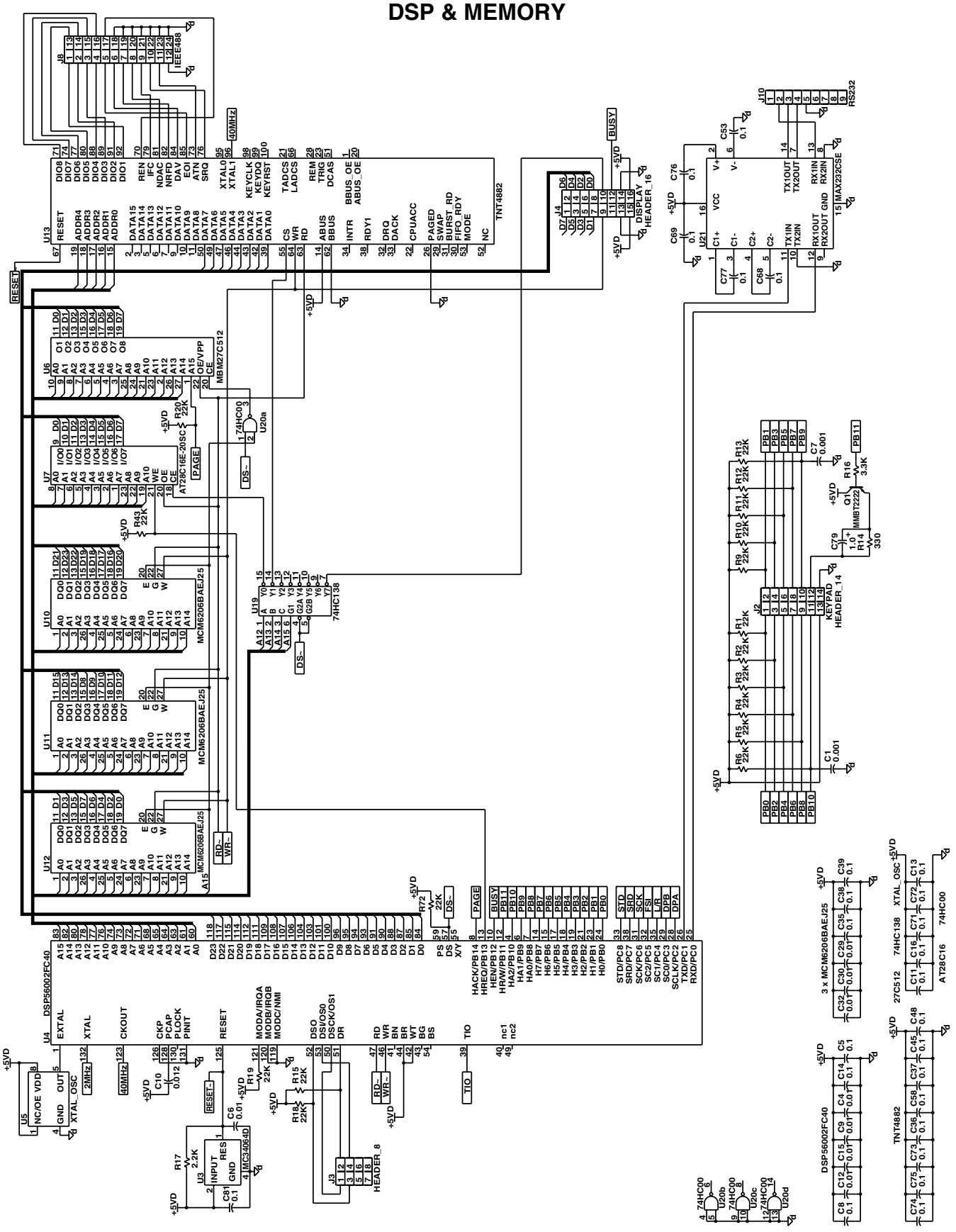
ENCODER/SWITCH BOARD



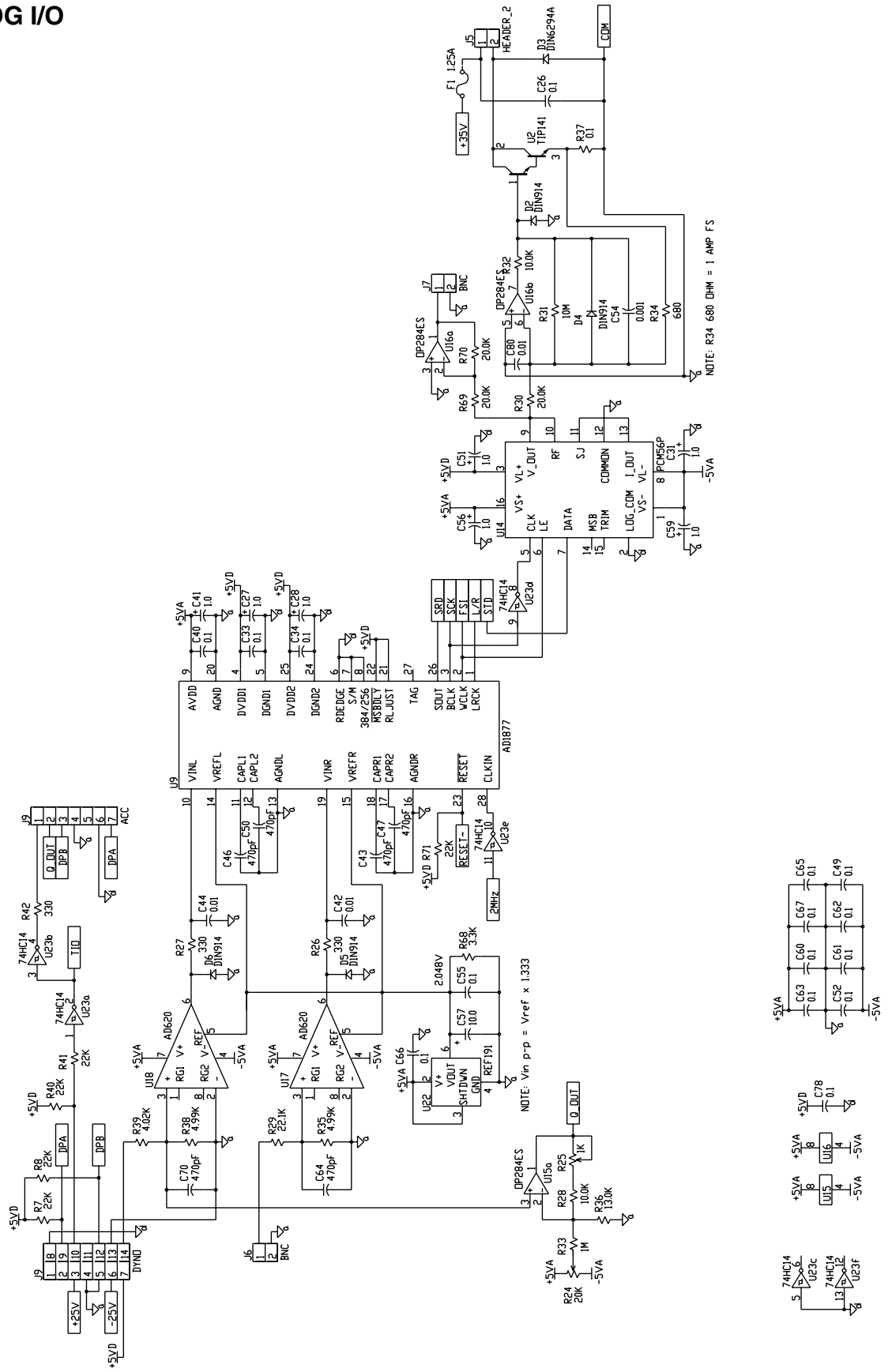
POWER SUPPLY



DSP & MEMORY



ANALOG I/O


F1 1.25A
+35V
J5
HEADER_2
D3
DIN6294A
COM
U2
TIP141
R37
0.1
D2
DIN914
C26
0.1
R32
10.0K
U16b
OP284ES
R31
10M
D4
DIN914
C54
0.001
R34
680
C80
0.01
NOTE: R34 680 OHM = 1 AMP FS
J7
BNC
U16a
R70
20.0K
R69
20.0K
R30
20.0K
U14
PCM56P
C51
1.0
C56
1.0
C59
1.0
C31
1.0
+5VD
+5VA
-5VA
CLK
LE
DATA
MSB
TRIM
LOG_COM
V_OUT
RF
SJ
COMMON
I_OUT
VL+
VL-
VS+
VS-
74HC14
U23d
SRD
SCK
FSI
L/R
STD
U9
AD1877
AVDD
AGND
DVDD1
DGND1
DVDD2
DGND2
RDEDGE
S/M
384/256
MSBDLY
RL_JUST
TAG
SDOUT
BCLK
WCLK
LRCK
VINL
VREFL
CAPL1
CAPL2
AGNDL
VINR
VREFR
CAPR1
CAPR2
AGNDR
RESET
CLKIN
C41
1.0
C40
0.1
C27
1.0
C33
0.1
C28
1.0
C34
0.1
C46
470pF
C50
470pF
C43
470pF
C47
470pF
R71
22K
RESET
74HC14
U23e
2MHz
C44
0.01
C42
0.01
R27
330
R26
330
D6
DIN914
D5
DIN914
R68
3.3K
C55
0.1
C57
10.0
2.048V
REF191
U22
VOUT
SHTDWN
GND
C66
0.1
U18
U17
AD620
RG1
RG2
REF
R39
4.02K
R38
4.99K
R29
22.1K
R35
4.99K
C70
470pF
C64
470pF
NOTE: Vin p-p = Vref x 1.333
J6
BNC
J9
DYND
+25V
-25V
R8
22K
R7
22K
R40
22K
R41
22K
R42
330
74HC14
U23b
U23a
TID
DPA
DPB
Q_OUT
ACC
U15a
OP284ES
R25
1K
R28
10.0K
R36
130K
R33
1M
R24
20K
C65
0.1
C49
0.1
C67
0.1
C60
0.1
C62
0.1
C63
0.1
C61
0.1
C52
0.1
C78
0.1
U16
U15
74HC14
U23c
U23f

Glossary of Abbreviations and Terms

BNC ..... bayonet, locking-type connector

CCW ..... counterclockwise (turn to left)

CR ..... carriage return

CW ..... clockwise (turn to right)

DMM ..... digital multimeter

GPIB (General Purpose Interface Bus) ..... parallel interface port; interchangeable with IEEE-488

Hp ..... horsepower; measure of mechanical power

Hz ..... hertz; frequency

I/O ..... input/output

LF ..... line feed

LIFO ..... LAST IN = FIRST OUT; memory function

local ..... manual control (use front panel controls)

mVDC ..... millivolts DC

N ..... speed

NEMA ..... National Electrical Manufacturers Association

PMDC ..... permanent magnet DC

Q ..... torque

remote ..... computer control (uses programmed controls from computer)

RPM ..... revolutions per minute

SI ..... Systeme Internationale units of measure

S/s ..... samples per second

V ..... volts; typically AC

VDC ..... volts DC

Notes

Magtrol Limited Warranty

Magtrol, Inc. warrants its products to be free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment. Software is warranted to operate in accordance with its programmed instructions on appropriate Magtrol instruments. This warranty extends only to the original purchaser and shall not apply to fuses, computer media, or any other product which, in Magtrol's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or shipping.

Magtrol's obligation under this warranty is limited to repair or replacement of a product which is returned to the factory within the warranty period and is determined, upon examination by Magtrol, to be defective. If Magtrol determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions of operation or shipping, Magtrol will repair the product and bill the purchaser for the reasonable cost of repair. If the product is not covered by this warranty, Magtrol will, if requested by purchaser, submit an estimate of the repair costs before work is started.

To obtain repair service under this warranty, purchaser must forward the product (transportation prepaid) and a description of the malfunction to the factory. The instrument shall be repaired at the factory and returned to purchaser, transportation prepaid. **MAGTROL ASSUMES NO RISK FOR IN-TRANSIT DAMAGE.**

THE FOREGOING WARRANTY IS PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE. MAGTROL SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

CLAIMS

Immediately upon arrival, purchaser shall check the packing container against the enclosed packing list and shall, within thirty (30) days of arrival, give Magtrol notice of shortages or any nonconformity with the terms of the order. If purchaser fails to give notice, the delivery shall be deemed to conform with the terms of the order.

The purchaser assumes all risk of loss or damage to products upon delivery by Magtrol to the carrier. If a product is damaged in transit, PURCHASER MUST FILE ALL CLAIMS FOR DAMAGE WITH THE CARRIER to obtain compensation. Upon request by purchaser, Magtrol will submit an estimate of the cost to repair shipment damage.

MAGTROL

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MOTOR TESTING EQUIPMENT ◆ HYSTERESIS BRAKES AND CLUTCHES