DyneSystems, Inc.

Midwest & Dynamatic Dynamometers

DS507

Eddy Current Power Amplifier Unit

Installation and User's Manual

Revised October 2000

Dyne Systems, Inc.

Contact Information

Address:
W209 N17391 Industrial Drive
Jackson, WI 53037
U.S.A.

Toll-Free Phone:
(800) 657-0726

Fax:
(262) 677-9308

Website:
www.dynesystems.com

Revision History

Item #: MAN-DS507-00001

March 21, 2000
Initial Version

October 4, 2000
Revised Version

Table of Contents

Chapter 3 – DS-507 Setup

Chapter 4 – Using the DS-507

Chapter 5 – Troubleshooting

Chapter 6 – Service

Index

Chapter 1

Introduction

The DS507 Eddy-Current Power Amplifier provides 10 to 100 ADC dynamometer field excitation at up to 430 Vdc. This amplifier complements the Dyn-Loc IV (Digital Dynamometer Controller). The DS507 provides field forcing for both increasing and decreasing current changes, improving stability and transient response over non-regenerative types.

The DS507 provides current-source control, displaying maximum voltage during current changes and normally-rated field voltage during steady-state conditions.

This manual explains how to set up, calibrate, and maintain the DS-507 board.

1.0 Audience

Dyne Systems assumes the following regarding the users of this product.

- Personnel responsible for *equipment use* have knowledge of dynamometers, engines/motors, instrumentation related to the testing required, and test procedures required.
- Personnel responsible for electrical connections are registered electricians, with an understanding of general power and signal wiring, conduit segregation and the related devices.
- Personnel responsible for the PLC logic have experience in all the above, plus PLC programming/use and interlocking concepts.

2.0 Location Requirements

For safe and reliable operation, check that:

- All electrical and mechanical connections are secure and in compliance with their respective schematics in the *Drawings* section of this manual.
- The system is installed away from any liquids or condensation.
- The system is safe from physical shock and jarring.

3.0 Environment Requirements

The installation environment must conform with state and local standards concerning the provision of protective earth-ground terminal for equi-potential connection. The room containing the system must also comply with the following specifications:

Ambient Temperature:	0 to 35° C
Relative Humidity:	10 – 90% Non-condensing
Altitude:	Sea level – 3300 ft

4.0 Safety

To prevent physical injury, follow basic safety precautions when installing, operating, and maintaining this equipment.

To ensure safe and reliable operation:

- Follow all instructions in this manual.
- Always cancel power to this equipment before opening the enclosure door.
- Obey all safety signs on the equipment and in this manual.
- Use proper point-of-operation safeguarding.

For these and other safety precautions, refer to the American National Standards Institute (ANSI) or the Occupational Safety and Health Administration (OSHA).

4.1 Electrocution Hazard

This product and associated components are electrically energized. Electric shock may cause serious injury or death. Always disconnect line voltage before servicing the unit or any associated components.

⚠

DANGER: Disconnect all power before opening the enclosure door or servicing the unit and any associated components. Failure to do so may result in serious injury or death.

Only certified electricians must install this equipment. Unskilled or unauthorized personnel attempting to install this equipment may cause equipment damage, serious injury, or death.

4.2 Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage sensitive microchips and semiconductors on circuit boards in the PAU cabinet and other internal components. Always wear some manner of ESD-grounding device, such as a wrist strap, when handling internal components.

CAUTION: Failure to observe ESD-grounding precautions may damage sensitive components.

4.3 Safety Signs and Symbols

4.3.1 System Safety Labels

This test system displays various labels and signs highlighting and explaining caution and danger areas. Obey these signs when operating this machinery. These signs comply with the American National Standards Institute (ANSI Z535) and the Occupational Safety and Health Administration (OSHA 1910.145). The signs depict one of the following conditions:

Danger

Danger signs and labels indicate imminently hazardous situations resulting in death or serious injury if not avoided.

Warning

Warning signs indicate potentially hazardous situations resulting in death or serious injury if not avoided.

Caution

Caution signs and labels indicate potentially hazardous situations resulting in minor or moderate injury if not avoided.

4.3.2 Documentation Conventions

Some parts of this manual describe information in the form of notes, cautions, and danger signs. Refer to this section for descriptions of these callouts.

Note: Notes provide supplemental information related to a procedure.

CAUTION: Cautions with no safety symbol indicate conditions that may cause equipment damage, or data loss if instructions are not followed exactly as given.

CAUTION: Cautions displaying the safety symbol indicate conditions that may cause physical injury as well as equipment damage, or data loss if instructions are not followed exactly as given.

DANGER: Dangers indicate conditions that may cause death or serious injury if instructions are not followed exactly as given.

5.0 Related Manuals and Drawings

Dyn-Loc IV User's Manual

This manual explains how to install, operate, and maintain the Dyn-Loc IV Digital Dynamometer Controller.

Drawing Number Chart

Drawing Number	Assembly Number	Max Amps	Line Input	Output
DWG-507-SCH-001	DS507-15-FH-001	15	208	200
DWG-507-SCH-002	DS507-15-FJ-001	15	208	230
DWG-507-SCH-003	DS507-15-FL-001	15	208	400
DWG-507-SCH-004	DS507-15-HH-001	15	240	200
DWG-507-SCH-005	DS507-15-HJ-001	15	240	230
DWG-507-SCH-006	DS507-15-HL-001	15	240	400
DWG-507-SCH-007	DS507-15-LH-001	15	480	200
DWG-507-SCH-008	DS507-15-LJ-001	15	480	230
DWG-507-SCH-009	DS507-15-LL-001	15	480	400
DWG-507-SCH-020	DS507-25-FH-001	25	208	200
DWG-507-SCH-019	DS507-25-FJ-001	25	208	230
DWG-507-SCH-018	DS507-25-FL-001	25	208	400
DWG-507-SCH-021	DS507-25-HH-001	25	240	200
DWG-507-SCH-022	DS507-25-HJ-001	25	240	230
DWG-507-SCH-017	DS507-25-HL-001	25	240	400
DWG-507-SCH-023	DS507-25-LH-001	25	480	200
DWG-507-SCH-024	DS507-25-LJ-001	25	480	230
DWG-507-SCH-025	DS507-25-LL-001	25	480	400
DWG-507-SCH-034	DS507-50-FH-001	50	208	200
DWG-507-SCH-035	DS507-50-FJ-001	50	208	230
DWG-507-SCH-036	DS507-50-FL-001	50	208	400
DWG-507-SCH-039	DS507-50-HH-001	50	240	200
DWG-507-SCH-038	DS507-50-HJ-001	50	240	230
DWG-507-SCH-037	DS507-50-HL-001	50	240	400
DWG-507-SCH-040	DS507-50-LH-001	50	480	200
DWG-507-SCH-041	DS507-50-LJ-001	50	480	230
DWG-507-SCH-042	DS507-50-LL-001	50	480	400

Chapter 2

Specifications

The DS-507 power amplifier is rated for 480 Vac single-phase line input, which yields a maximum of 430 Vdc output with ratings of 10 – 100 Adc. This unit requires an isolation transformer, rated for the appropriate voltage and current being handled, for proper operation. This chapter describes the specification of the DS-507 power amplifier.

1.0 Unit Specifications

1.1 Enclosure Dimensions (HxWxD)

20.00 in. x 16.00 in. x 8.00 in.

1.2 Location

For safe and reliable DS507 operation, check that:

- All electrical connections are secure and in compliance with the appropriate schematic in the *Drawings* section.
- All air-flow vents on the DS507 have a minimum six-inch clearance for proper air flow.
- All air-flow vents on the DS507 are clear and free of dust.
- The unit is installed away from any liquids or condensation.
- The unit is safe from physical shock and jarring.

1.3 Unit Specifications

Type of Control:	Line Regenerative, current source
Over-Temperature Safety:	Thermal switch contact, NC, non-latching
Enclosure Mounting:	Nema 1, forced air cooled, wall mounted
Sub Panel Mounting:	In the enclosure
Output Current Ratings:	0 – 10, 0 – 25, 0 – 50, 0 – 100 ADC
Output Current Scaling:	From 10% – 100% rated, user adjustment
Current Reference Signal:	0 to +10 VDC for 0 to 100% scale, isolated
On/Off Control:	+5 to +25 VDC for ON condition, isolated

1.4 Voltage Ratings

The installation environment must conform with the U.S. National Electric Code (IEC) standard concerning the provision of protective earth-ground terminal for equi-potential connection. The room containing the DS507 must also comply with the following temperature and power requirements:

Maximum Input Voltage:	480 VAC, single phase
Maximum Output Voltage:	± 430 VDC (during transients)
Isolation Transformer:	Varies, dependant upon application (required to reduce line disturbances)

2.0 Environment Requirements

Maximum Ambient Temperature:	0 to 45° C
Relative Humidity:	Non-condensing

Chapter 3

DS-507 Setup

1.0 Before You Begin

Some system components may have been damaged during shipment due to shifting or mishandling. Visually inspect all parts and cross reference all items with the packing slip to ensure that all components are accounted for and undamaged.

2.0 Electrical Installation Guidelines

This section lists guidelines for installing components associated with almost any Eddy Current dynamometer. All electrical system connections must be installed by a qualified electrician. Electrical connection specifications are provided in the form of electrical schematics.

⚠ ***DANGER:*** Only qualified electricians must install this equipment. Unskilled or unauthorized personnel attempting to install this equipment may cause equipment damage, serious injury, or death.

Use the guidelines in this chapter in conjunction with the electrical schematics in the *Drawings* section to accurately connect the DS-507 and minimize electrical noise, a characteristic of high performance drives.

⚠ ***DANGER:*** Follow all guidelines listed in this section to ensure safe system installation and operation. Follow all state and local codes when connecting this equipment.

Failure to follow these guidelines and state and local codes may result in equipment damage, serious injury, or death.

2.1 Signal Wiring

Enclose all signal circuits in separate conduit from the AC and DC power wiring. Any other wiring that creates high frequency noise, such as thermocouples, motor switches etc., must also be separated in this manner.

3.0 Mounting the Enclosure

This section explains how to mount the enclosure to a predetermined location. Refer to Chapter 2 – Specifications for dimensions of the enclosure used in your system.

To mount the enclosure:

1. Select the appropriate location for installation.
2. Open the enclosure door.
3. Place the enclosure on the wall at the installation location.

Note: Allow at least 6 in. on both the right and left sides of the enclosure to allow sufficient space for the air vents.

4. Mark the enclosure's mounting holes on the facility's wall.
5. Remove the enclosure from the wall.

CAUTION: This equipment contains sensitive circuit boards and processors. Avoid drilling holes to the facility's wall through the enclosure. Failure to avoid interference with internal components may result in equipment damage.

Dyne Systems does not recommend drilling any holes in the enclosure. Drilling creates metallic debris that may cause damage to electronic equipment.

6. Tap four 5/16-in. holes at the marked locations.

7 Attach the enclosure to the wall using customer-supplied 5/16-in. bolts and washers.

Note: The enclosure manufacturer recommends using the provided sealing washers to ensure proper sealing and enclosure protection.

4.0 Connecting the DS-507

This section explains how to install the DS-507 enclosure and all electrical wiring.

4.1 Creating Conduit Holes

Connect the DS-507 power amplifier to the system by creating knock-out holes and running conduit from the system components and line voltage. The DS-507 requires at least two holes for line voltage and signal connections. Due to the flexibility of this system, the DS-507 enclosure does not ship with conduit holes. This lets you decide the optimum number and location of conduit holes, depending on system requirements.

Note: Dyne Systems Co., LLC recommends shielding all conduit when connecting any system equipment.

Before You Begin: Read the instructions explained in *Electrical Installation Guidelines* on page 3.1 before proceeding with this procedure.

To create conduit holes in the enclosure:

1 Mount the enclosure in the predetermined location. Refer to *Mounting the Enclosure* on page 3.2.

2 Create knock-out holes in the appropriate locations using a knock-out punch driver.

CAUTION: This equipment contains sensitive circuit boards and processors. Always check the inside of the enclosure for obstructions before creating holes. Failure to avoid interference with internal components may result in equipment damage.

Dyne Systems does not recommend drilling any holes (except punch pilot holes) in the enclosure. Drilling creates metallic debris that may cause damage to electronic equipment.

Note: The required number of conduit holes varies, depending on the size of your system. The system requires at least two knock-out holes to accommodate 480 Vac line voltage input and signal connections.

Dyne Systems recommends creating conduit holes on the bottom of the enclosure, as the terminal block is located at the bottom of the internal sub panel.

4.2 Connecting the DS-507

This section explains how to wire the DS-507 to the system. Use electrical schematics in the *Drawings* section in conjunction with the guidelines in this section.

To connect the DS-507:

1. Determine the location of each system component before installing anything.
2. Make sure all power is disconnected from the entire system.

⚠ ***DANGER:*** Always make sure line voltage is disconnected before connecting power cables to the enclosure. Failure to do so may result in serious injury or death.

3. Attach the electrical components as explained in the appropriate wiring schematics, located in the *Drawings* section.
4. Consider the following guidelines when connecting the DS-507:

   •*Isolation Transformer Guidelines* on page 3.5
   •*General Connection Guidelines* on page 3.5.
   •*Using the DS507 with the Dyn-Loc IV* on page 3.5.
   •*Thermal Switch* on page 3.6.
   •*Using The DS507 With Other Devices* on page 3.6.

5. Visually inspect all connections and make sure that they are all secure and in compliance with all schematics in the *Drawings* section and the guidelines listed below.

4.2.1 Isolation Transformer Guidelines

Dyne Systems typically supplies the appropriate isolation transformer, related to your dynamometer field rating. If you are supplying your own isolation transformer, calculate the kilo Volt Amps (KVA) rating by using the following formula:

$$KVA = 480V \times I_f$$

$$I_f = dynamometer field - current rating$$

Note: Use a KVA rating equal to or greater than that calculated.

Consider the following guidelines when connecting the DS-507 to the isolation transformer:

- You may reconnect the primary for 240 Vac. If doing so, you must also reconnect the small 50 VA T1 control transformer.
- You may reconnect the large isolation transformer's secondary for any possible voltage (480 Vac or less). Using less than 480 Vac proportionately reduces the transient regulator response.

4.2.2 General Connection Guidelines

- Connect the ground to the facility through the conduit housing the power wires.
- The sub panel and enclosure are considered groundable.
- Do not ground the analog common connection at terminal block 1.
- The field circuit should have no contactors or extra fuses. If you want extra fuses, wire them to the isolation transformer secondary at terminal blocks 9 and 10.
- Maintain all power connections routed away from signal cables.
- If using 240V primary power, you must reconnect internal transformer T1 for 240V and size the current rating of the fuses and primary wiring accordingly.

4.2.3 Connecting the DS507 with the Dyn-Loc IV

When using a Dyn-Loc IV, the DS-507 acts as a replacement for the internal Dyn-Loc power amp, allowing higher (forcing) voltage and more current. Follow these guidelines when connecting the DS-507 to a Dyn-Loc IV (Refer to the *Dyn-Loc IV User's Manual* for help with connections):

- The system requires signal connections between the Dyn-Loc IV and the DS507.
- Connect the DS-507 to the Dyn-Loc's 15-pin female sub-D connector. Wire as follows.
  - Terminal Block point 1 to sub-d pin 10 (Analog common/logic return)
  - Terminal Block point 2 to sub-d pin 9 (0 to +10 VDC Analog reference)
  - Terminal Block point 4 to sub-d pin 5 (+5 VDC Dyne ON logic)

  (labeled Four Quad. I/O). Contact Dyne Systems for proper parts if not supplied with the DS-507.
- Applications requiring currents greater than 16 A and/or input voltage greater than 277 Vac, the DS507 replaces the Dyn-Loc IV internal eddy-current power amplifier. This configuration does not require the use of the Dyn-Loc IV L1-L2 and F1-F2 connections.
- You must route the signal cable in conduit separately from the power wiring.
  Any other wiring that creates high frequency noise, such as thermocouples, motor switches etc., must also be separated in this manner.

- Use signal cable conduit entry and cable routing to maintain good spatial separation from power wiring.
- Refer to the drawings for additional information.

Note: The SubD connector, pins, and back shell are usually provided with the control.

4.2.4 Thermal Switch

You may wire the DS507 internal thermal switch (TC1-TC2) in series with the Dyne On Logic (or the H20 Dyn-Loc interlock), or wire into the users safety logic system.

Note: This switch opens if the heatsink temperature exceeds 125°C. This is a non-latching contact.

4.2.5 Connecting The DS507 With Other Devices

User devices, such as computers, potentiometers, etc., may be used to control the DS507 field output current. Ensure that your device is interlocked to prevent field excitation if the dynamometer coolant flow is inadequate.

- Current reference required from the device used is 0 to +10 Vdc at up to 1 MA. The contact should be a dry-circuit type if using a contact in this circuit.
  Limit the analog reference to +10 Vdc.
- On logic required is 0 Vdc for an OFF condition and +5 to 25 Vdc for an ON condition.
- An On condition is required to cause field current flow, despite the reference signal condition. Wire as follows.
  - Connect the positive lead of the 10 volt reference supply to Terminal Block point 2. Connect the negative lead to Terminal Block point 1.
  - The simplest method of Dyne ON logic connected to the DS507 is a relay contact or switch. Connect one side of the relay contact to the Terminal Block point 3, and the other side to Terminal Block point 4. When the relay contact is closed, the DS507 internal +15 VDC supply will be connected to the Dyne On logic input. This makes Dyne ON logic true, and dyne field current may then flow at the level commanded by the analog reference.
- Other methods of driving the Dyne On logic include solid state logic. Contact Dyne Systems for help with applications of this nature.
- Logic considerations revolve around 3-wire control. Dyne Systems recommends using the thermostatic contact as an over-temp safety.
- You may connect the TC1-TC2 heat sink over-temperature contact in series with the On contact, or into the safety logic circuits. This is a non-latching contact. If you require a means of connection other than those listed, contact Dyne Systems for assistance.

5.0 Starting the DS-507

This section explains how to start and set up the DS-507 power amplifier.

5.1 Preliminary Power On Tests

1. Make sure that **Dyne On** is *not* energized, the analog reference is set to zero (0), and the fuses and wires are properly connected.
2. Apply 480 Vac input power to the DS-507.
3. Check the transformer input and output voltages.
4. Ensure the DS-507 fan is running.
5. Use a multi-meter to measure the following:

Table 3.1:

Measure This Voltage:	Between :	And:	Notes:
480 Vac	Terminal block 5	Terminal block 6	
	Terminal block 7	Terminal block 8	
	Terminal block 9	Terminal block 10	
0 Vdc	Terminal Block 13	Terminal Block 14	
	TB 1-5	TB 1-3	On the DS-507 PCB (Dyne = Off)
	TB 1-4	TB 1-3	On the DS-507 PCB (ref = 0)
120 Vac	TB 1-7	TB 1-8	On the DS-507 PCB
+15 Vdc	TB 1-1	TB 1-3	
	TP 12	TP 14	
-15 Vdc	TB 1-2	TB 1-3	
	TP 13	TP 14	

6. If these measurements are not found, re-check the fuses and wiring.

5.2 Checking the System

5.2.1 Checking the Dynamometer Coil Rating

Before You Begin: Make sure all connections are secure and in compliance with all state and local codes.

To get the dyno coil rating:

Inspect the dynamometer name plate for the rated:
•Amps
•Ohms
•Volts

If one of the three measurements is missing, calculate the third using Ohm's Law:

$$Volts = Amps \cdot Ohms$$

$$Ohms = \frac{Volts}{Amps}$$

$$Amps = \frac{Volts}{Ohms}$$

If no data is available, measure the dynamometer field ohms with a four-terminal connection instrument (with one field coil lead disconnected from the DS 507).

5.2.2 Calibrating the Field-Current/Voltage

Before You Begin: Make sure all connections are secure and in compliance with all state and local codes.

To set the maximum field-current/voltage with the Dyn-Loc IV:

1. Set the DS507 Current Feedback (CFB) potentiometer (POT) is turned fully counter-clockwise for minimum current.

Note: This is a single-turn POT.

---

2. Use a voltmeter for measuring the DS-507 output across the field lead connections, or connect a clamp-on ammeter on a field lead.
3. Make sure the dynamometer cooling water is flowing at an acceptable rate.
4. In the RPM mode, set the active leverwheels to a value above the displayed dyno rpm. This sets the analog reference to zero (0).
5. Press **Dyne On** on the Dyn-Loc.
6. Reduce the active lever wheels to below the displayed dyno rpm, or press the emergency stop button. Make sure the Dyn-Loc fault brake pot (if one is present) is not set at 0%.

This will slowly increase the analog reference to +10 Vdc. Observe the field current. The analog current should read approximately 3 A.

7 Maintain +10 Vdc and observe any problems.
If no problems arise, continue with step 8.
If problems arise, press **Dyne Off**.

CAUTION: Failure to do so in the event of a problem may result in equipment damage.

---

8 Turn the POT clockwise, monitoring the current or voltage, to reflect the rated field current, or 20% below the rating of fuse F1/F2, whichever is lowest.

9 Press **Dyne Off** and/or EM stop reset.

10 Set the leverwheels high to set the analog reference to zero (0).

To set the maximum field-current and voltage ratings with other devices:

1 Set the DS507 Current Feedback (CFB) potentiometer (POT) is turned fully counter-clockwise for minimum current.

Note: This is a single-turn POT.

---

2 Use a voltmeter for measuring the DS-507 output across the field lead connections, or connect a clamp-on ammeter on a field lead.

3 Make sure the dynamometer cooling water is flowing at an acceptable rate.

4 Set the analog reference to zero (0).

5 Engage the enable contact.

6 Slowly increase the analog reference to +10 Vdc, observing the field current or voltage. The analog current should read approximately 3 A.

7 Maintain +10 Vdc and observe any problems.
If no problems arise, continue with step 8.
If problems arise, disable the **On** contact.

CAUTION: Failure to do so in the event of a problem may result in equipment damage.

---

8 Turn the POT clockwise, monitoring the current or voltage, to reflect the rated field current, or 20% below the rating of fuse F1/F2, whichever is lowest.

9 Disable the **On** contact.

10 Set the analog reference to zero (0).

Chapter 4

Using the DS-507

1.0 Using the DS-507 with the Dyn-Loc IV

The DS-507 operation is transparent when using the Dyn-Loc IV. All of the Dyn-Loc IV circuits and controls work normally. Refer to the Dyn-Loc IV User Manual for additional information about the system's operation.

2.0 Using the DS-507 with Other Devices

When the ON contact is enabled, the field current will flow proportional to the analog reference voltage. +10 volt will command the maximum field current. If the ON contact is disabled, no field current will flow.

Chapter 5

Troubleshooting

Use the following test points to troubleshoot system problems. You must be a skilled technician to use this information.

TP5 (CFB) with respect to TP14 PCOMM

Current feedback. This is a DC voltage that approximates the Field Current level. This will be relatively pure DC for high inductance field coils above the low level continuous conduction point. This may have significant ripple at very low current levels, or when driving low inductance field coils, or those failed coils having shorted turns.

TP1 (ISOREF) with respect to TP14 PCOMM

Isolated Analog Reference. This is the same as the Analog Reference that is input to the DS507 PCB, except that has passed through a linear optical isolation stage (IC-6) and has had small offset and gain adjustments done. 0 V DC Analog Reference input yields approximately +.60 V DC at TP1. +10 V DC Analog Reference input yields approximately +13.50 V DC (saturation value) at TP1.

TP4 (IRSHUNT) with respect to TP7 COMMI

This test point could be used to temporarily (+ or -) bias the Analog Reference, but is mainly used by Dyne Systems in setting up to adjust TP1 with VR4 and VR5.

TP3, TP2, and TP6 allow monitoring AC waveforms with an oscilloscope when troubleshooting or adjusting VR2. Consult Dyne Systems for more information about these test points, assuming the equipment and skilled personnel are available.

Chapter 6

Service

If this manual does not solve any problems you experience using the DS-507, or for any other system-related questions or comments, contact Dyne Systems Co., LLC.

Address

W209 N17391 Industrial Drive
Jackson, WI 53037

Phone

Telephone: (262) 677-9300
Toll Free: (800) 657-0726
Fax: (262) 677-9308

World Wide Web

http://www.dynesystems.com

Index