ITW Ransburg
Electrostatic Systems

SERVICE INSTRUCTION
SI-70-52-10-B
REPLACES SI-70-52-10-A

FIBER OPTIC PULSETRACK™ SPEED MONITOR AND CONTROL SYSTEM SERVICE INFORMATION

IMPORTANT: Read and follow all instructions and SAFETY PRECAUTIONS before using this equipment. Retain for future reference.

U.S.A. AND FOREIGN PATENTS PENDING

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SAFETY PRECAUTIONS

This manual contains information that is important for you to know and understand. This information relates to USER SAFETY and PREVENTING EQUIPMENT PROBLEMS. To help you recognize this information, we use the following symbols. Please pay particular attention to these sections.

⚠ DANGER

Urgent safety information – a hazard that will cause serious injury or loss of life.

WARNING

IMPORTANT SAFETY INFORMATION – A HAZARD THAT MAY CAUSE SERIOUS INJURY OR LOSS OF LIFE.

CAUTION

Important information that tells how to prevent damage to equipment, or how to avoid a situation that might cause minor injury.

Note

Information that you should pay special attention to.

SAFETY PRECAUTIONS

MAJOR HAZARDS

WARNING

THE FOLLOWING HAZARDS MAY OCCUR DURING THE NORMAL USE OF THIS EQUIPMENT. PLEASE READ THE FOLLOWING CHART.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Personnel Safety - Electrical Hazards 	The high voltage equipment used in this application creates a hazard for personnel. The high voltage can cause injury, and a spark from the equipment to a person is capable of igniting coating material.	High voltage equipment must be isolated from personnel. Booths, fencing, railings or other means must be placed around the equipment and maintained to assure safe isolation of the process. The high voltage equipment must be deenergized prior to allowing personnel to enter the spray area.
Personnel Safety - Mechanical Hazards 	The atomizer rotates at speeds up to 60,000 RPM. At these speeds, the edge of the bell can easily cut into skin. Loose articles can also be caught by the rotating bell.	Personnel must stay clear of the bell whenever it is rotating. Before touching the bell, the turbine air must be shut off. If the bell has been rotating, allow at least three minutes for it to come to a complete stop before touching it. If the air brake feature is utilized, the bell can be stopped in a shorter period.
General Use and Maintenance	Personnel must be properly trained in the use of this equipment. Improper operation or maintenance can cause hazardous conditions.	Personnel must be given training in accordance with the requirements of NFPA-33, Chapter 15. Read all instructions prior to use. Reference NFPA-33,OSHA 1910.107 and your particular local codes and insurance requirements.

DESCRIPTION

The Fiber Optic PulseTrack turbine speed monitor and closed loop control system, Figure 1, consists of an SMC-501 Electronics Panel, an SMC-507 Monitor Package (for RPM installation), or an SMC-508 Monitor Package (for RMA installation), and either an SMC-503 or SMC-505 Control Package (for 115 V installation) or an SMC-503A or SMC-505A Control Package (for 230 V installation). Fiber Optic PulseTrack monitor-only systems do not include the SMC-503/505 or SMC-503A/505A Control Packages.

The Fiber Optic PulseTrack system connects to the DeVilbiss Aerobell Air Bearing Rotary Atomizer to monitor and control its turbine speed. The Fiber Optic PulseTrack can monitor and control from 1 to 5 Aerobells. Each Aerobell being monitored requires a separate monitor package. Each Aerobell being monitored and controlled requires a separate monitor package and a control package. Refer to the Fiber Optic PulseTrack Configuration Table on the next page.

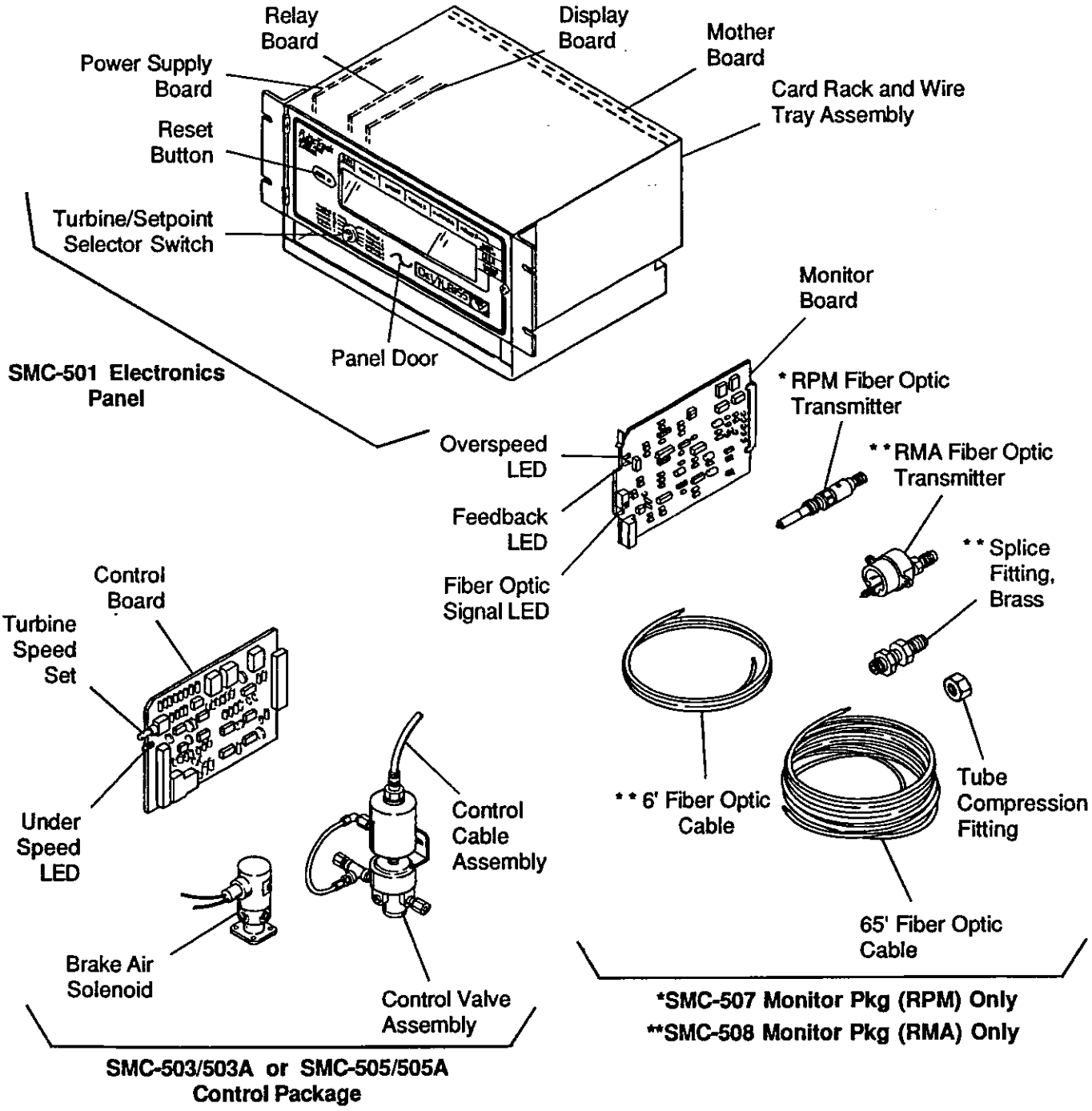

Figure 1. PulseTrack Speed Monitor and Control

PULSETRACK CONFIGURATION TABLE

SMC-501 Electronics Panel - Includes
SMC-401 Card Rack and Wire Tray Assembly
SMC-402 Power Supply Board Assembly
SMC-403A Relay Board Assembly
SMC-404 Display Board Assembly
SMC-411 Mother Board Assembly

ONE of two Monitor Packages:

1. **SMC-507 RPM Fiber Optic Monitor Package** - Includes
   SMC-29 RPM Fiber Optic Transmitter Assembly
   SMC-405A Monitor Board Assembly
   SMC-424 Fiber Optic Cable -- 65 feet
   SSP-7823 Compression Fitting

2. **SMC-508 RMA Fiber Optic Monitor Package** - Includes
   SMC-405A Monitor Board Assembly
   SMC-420 Fiber Optic Cable -- 6 feet
   SMC-421 RMA Fiber Optic Transmitter Assembly
   SMC-424 Fiber Optic Cable -- 65 feet
   SMC-427 Fiber Optic Splice Fitting Brass
   SSP-7823 Compression Fittings (3 per channel)

ONE of four Control Packages:

1. **SMC-503 Control Package** (for 115 V installations) - Includes
   SMC-406 Control Board Assembly (4 to 20 mA setpoint)
   SMC-409 Control Valve Assembly
   SMC-410 Control Cable Assembly
   SMC-414 Brake Air Solenoid Assembly (110 volt AC version)

2. **SMC-503A Control Package** (for 230 V installations) - Includes
   SMC-406 Control Board Assembly (4 to 20 mA setpoint)
   SMC-409 Control Valve Assembly
   SMC-410 Control Cable Assembly
   SMC-414A Brake Air Solenoid Assembly (220 volt AC version)

3. **SMC-505 Control Package** (for 115 V installations) - Includes
   SMC-409 Control Valve Assembly
   SMC-410 Control Cable Assembly
   SMC-414 Brake Air Solenoid Assembly (110 volt AC)
   SMC-416 Control Board Assembly (0 to 6 volt DC setpoint)

4. **SMC-505A Control Package** (for 230 V installations) - Includes
   SMC-409 Control Valve Assembly
   SMC-410 Control Cable Assembly
   SMC-414A Brake Air Solenoid Assembly (220 volt AC)
   SMC-416 Control Board Assembly (0 to 6 volt DC setpoint)

Notes:
1. Each electronics panel accommodates up to five monitor and control packages.
2. Each monitor or control package accommodates only one Aerobell.
3. Each control package requires a separate monitor package.
4. For remote setpoint with 4 to 20 milliamp operation, use SMC-406 Control Board Assembly. For remote setpoint with 0 to 6 volt operation, use SMC-416 Control Board Assembly.

Monitor System

The Fiber Optic PulseTrack monitor board receives feedback signals from the Aerobell turbine as shown in Figure 2. As the turbine rotates, two magnets located on the turbine rotor generate a flashed feedback signal each time they pass before a fiber optic transmitter's magnetic probe. This feedback signal energizes a high intensity, light-emitting diode (LED) mounted in the fiber optic transmitter, which causes the LED to flash. As the turbine speed increases, the frequency of the LED flashes increases as well. The LED light pulse is transmitted through the fiber optic cable to the monitor board.

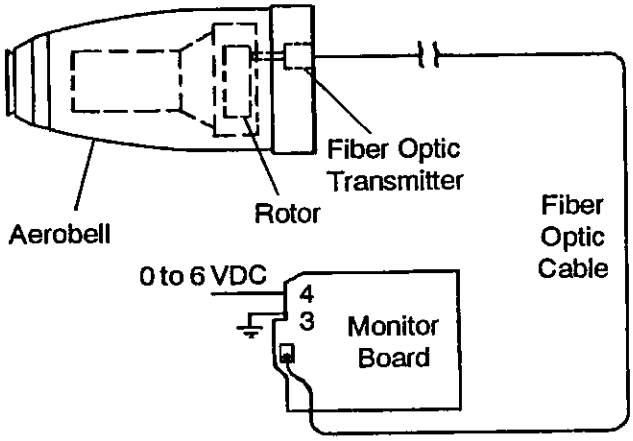

Figure 2. Signal Flow Diagram

In the monitor circuits, the feedback signals are changed into a voltage level from 0 to 9 volts DC. The voltage signal is directly proportional to the speed (RPM) of the Aerobell turbine being monitored. The signal is sent to terminal block TB401 pin 4 (TB401 pin 3 ground) for external display. The signal is also sent to the mother board for use by the control board and display board.

As the turbine generates feedback signals, the monitor system keeps a lookout for two fault conditions. The first fault condition is Loss-of-Feedback (LOF). If the feedback signal cannot be detected by the monitor board, the LOF relay on the relay board energizes, and an LED indicator on the electronics panel lights up. The LOF relay will energize when the turbine speed drops below 1500 rpm, or when there is a break in the feedback circuit.* The second fault condition is turbine overspeed. If the turbine speed exceeds 66,000 RPM, the monitor detects a fault condition, energizes the overspeed relay, and lights the overspeed fault LED on the electronics panel, Figure 3. If desired, the user can interlock the overspeed relay with a solenoid valve to shut down turbine air in the event of an overspeed condition.

* Loss-of-feedback also causes the control board to shut off the control signal to the control valve.

The monitor board also sends a turbine speed signal to the meter board where the speed (in thousands of RPM's) of any monitored turbine can be displayed with the turn of a selector switch. For example, 40,500 RPM is displayed as 40.5. Turbine speed output signals are also available from the monitor board as inputs to user-supplied remote display units, chart recorders, meters, etc.

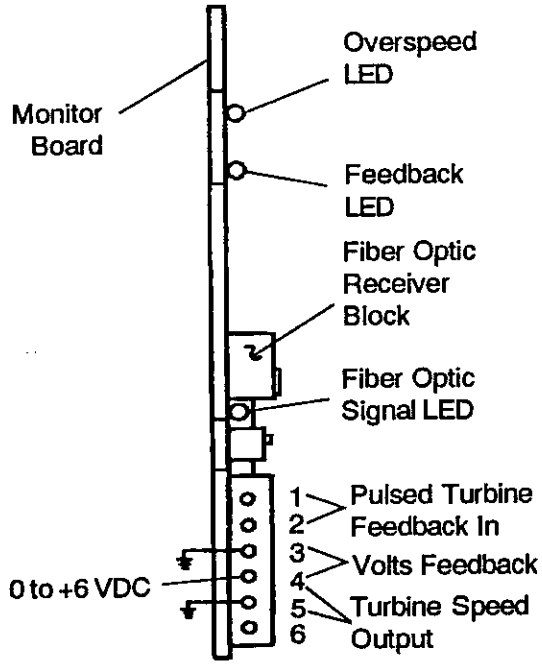

Figure 3. Monitor Board Terminals and LED's

Monitor and Control System

The Fiber Optic PulseTrack closed loop monitor and control system includes all the components of the monitor system plus additional control system components to provide both speed monitor and control capabilities. These capabilities include all the functions of the monitor system plus the following:

The control system uses the turbine speed information output from the monitor circuits to control the Aerobell turbine speeds, Figure 4. The output signals from the monitor circuits inform the control circuits of changes in turbine speeds. The control circuits use this information to determine the amount and direction (increase or decrease) of speed adjustments required to maintain the operator-selected setpoint speed. The necessary speed adjustments are then made by regulating an electromechanical control valve in the turbine air supply line.

Use of the optional air brake feature is recommended for optimal response to turbine speed setpoint changes. If the operator reduces the turbine speed setpoint ad-

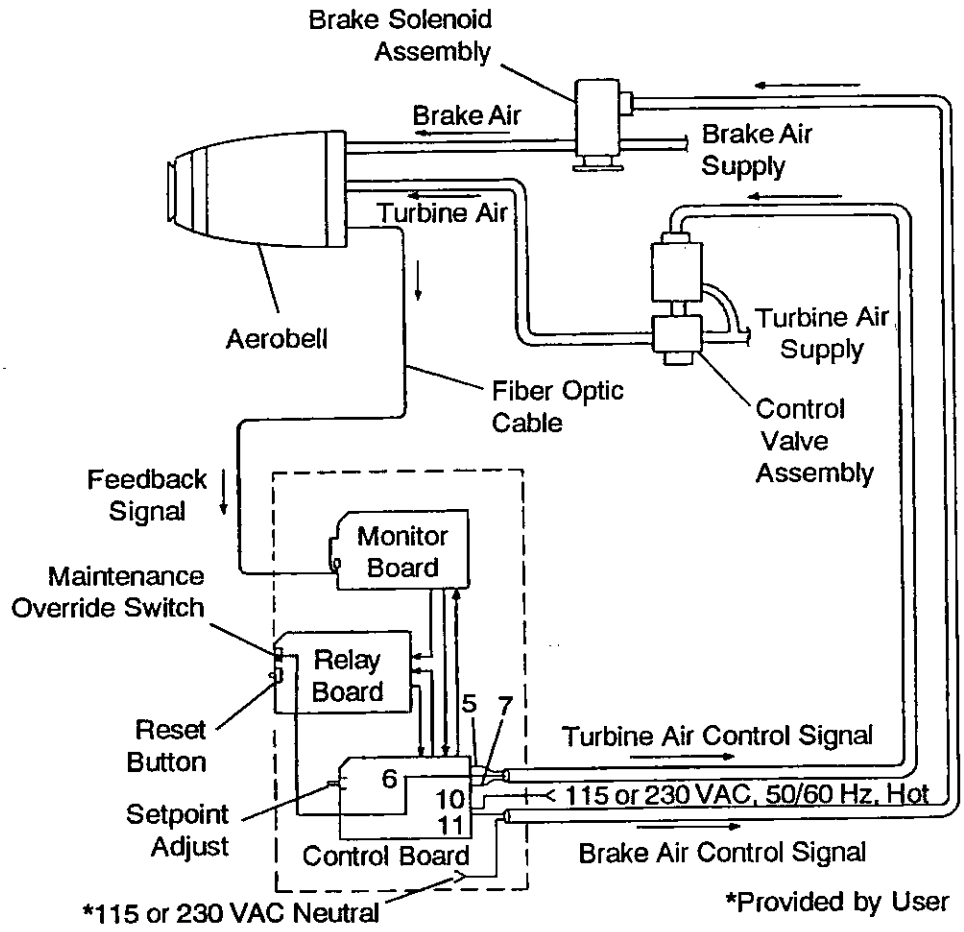

Figure 4. Monitor and Control Signal Diagram

justment by more than 3000 RPM, the control circuits close the control valve assembly in the turbine air supply line and open a brake solenoid in the turbine brake air supply line. Brake air is then directed against the rotation of the turbine, quickly slowing the speed of the turbine to approximately the new setpoint speed. When the turbine speed is within 3000 RPM of the new setpoint, the brake solenoid is shut off and the turbine control valve is automatically regulated to bring the turbine speed to the setpoint.

Operator responsibilities include entering the desired setpoint speed, activating the turbines, responding to fault conditions when a problem in the Aerobell system arises, and restarting the turbines after the problem is corrected. Among the fault conditions the control system can detect are loss-of-feedback, turbine overspeed, and percent underspeed. Loss-of-feedback and turbine overspeed are as discussed in the monitor system description, with the following exceptions: a loss-of-feedback fault will require a reset in the monitor and control system, and an overspeed or loss-of-feedback fault will cause the turbine air to shut down. The overspeed fault relay engages at 66,000 RPM and remains engaged until the reset button is pushed or a trigger signal is entered.*

The percent underspeed fault condition can only be detected with a monitor and control system.

Whenever the turbine speed falls below 50% of the selected setpoint speed, the control board activates the underspeed relay and lights the underspeed fault LED. (An underspeed fault will not shut down the turbines, unless configured to do so by the user.) The underspeed fault LED will remain lit until the problem is corrected and the RESET button is pushed or a remote reset is entered.*

Loss-of-feedback and overspeed may be latched or not latched using switches SW-402 and SW-403 on the monitor board. Loss-of-feedback must be unlatched for monitor only systems.

Loss-of-feedback and overspeed should be latched in normally operating control systems. Some retrofit (i.e., Behr retrofit) systems require overspeed to be unlatched for proper operation. Contact your DeVilbiss representative for further information.

* A remote reset can be provided by either a contact closure across pins 17 and 18 of the relay board or a DC voltage of 12 or 24 volts directly to pin 17.

Remote Controls and Indicators

Control connections are provided for remote setpoint and remote trigger inputs on the control and relay boards, Figure 5. Three modes of system control can be configured through these connections:

Maintenance or Setup Only

Local setpoint control with maintenance override switch.

Typical Modes of Operation

Local setpoint control with remote trigger input.

Remote setpoint control with remote trigger input.

Remote Setpoint Control

A local/remote slide switch on the control board, when moved to the remote position, gives the option to adjust setpoint speed from a remote control. To control setpoint speed remotely, a variable setpoint signal must enter at terminal 1 on the control board. A return ground-level signal line must be connected at terminal 2.

There are two modes of operation for remote setpoint input to the system: a modified 4 to 20 milliamp/1 to 5 VDC format (SMC-406 Control Board Assembly) and a 0 to 6 volt DC format (SMC-416 Control Board Assembly).

4 to 20 Milliamp Format/1 to 5 Volt DC Format

The SMC-406 Control Board Assembly uses a variation of the 4 to 20 milliamp/1 to 5 volt DC format commonly found in industrial environments (Z_{IN} = 249 ohms). The current signal input to terminal 1 must be in a range from 4.8 milliamps (minimum speed) to 16 milliamps (maximum speed). A linear relationship exists between the setpoint current signal and the turbine speed as defined in the following equation:

Setpoint Current Signal

EQUATION: I_{SP} = (desired speed ÷ 5000) mA + 4 mA
V_{SP} = ([desired speed ÷ 5000] mA + 4 mA) x 249 Ohms

EXAMPLE: If desired speed is 55,000 RPM, then
I_{SP} = (55,000 ÷ 5000) mA + 4 mA
= 11 mA + 4 mA
I_{SP} = 15 mA

EXAMPLE: If desired speed is 40,000 RPM, then
V_{SP} = ([40,000 ÷ 5000] mA + 4 mA) x 249 ohms
= (8 mA + 4 mA) x 249 ohms
= 12 mA x 249 ohms
V_{SP} = 3.00 volts DC

The following table is useful for determining proper setpoint current.

SMC-406 CONTROL BOARD

Current Input (milliamps) 4-20		(volts) 1-5 VDC	*Speed (RPM)
4.8	minimum level	1.20	4,000
5.0		1.25	5,000
6.0		1.50	10,000
8.0		2.00	20,000
10.0		2.50	30,000
12.0		3.00	40,000
14.0		3.50	50,000
16.0	maximum level	4.00	60,000

*All speeds are ±1% of full scale.

A current setpoint input of more than 16 milliamps to terminal 1 of the control board will not raise the setpoint above 60,000 RPM. A current setpoint input of less than 4.8 milliamps may cause the loss-of-feedback circuit to indicate a fault condition and require the operator to reset. To avoid incorrect fault indications, limit the input levels electronically to provide at least 4.8 milliamps. Remote setpoint controls can be provided with a separate control for each turbine or one control for all turbines.

0 to 6 Volt DC Format

The SMC-416 Control Board Assembly uses a setpoint voltage signal to terminal 1 of the control board in the range of 0.400 VDC (minimum speed) to 6 VDC (maximum speed) to establish the turbine speed. A linear relationship exists between the setpoint voltage signal and the turbine speed as defined in the following equation:

Setpoint Voltage Signal

EQUATION: V_{SP} = (desired speed ÷ 10,000) volts DC

EXAMPLE: If desired turbine speed is 47,500 RPM, then
V_{SP} = (47,500 ÷ 10,000) volts DC
V_{SP} = 4.75 volts DC

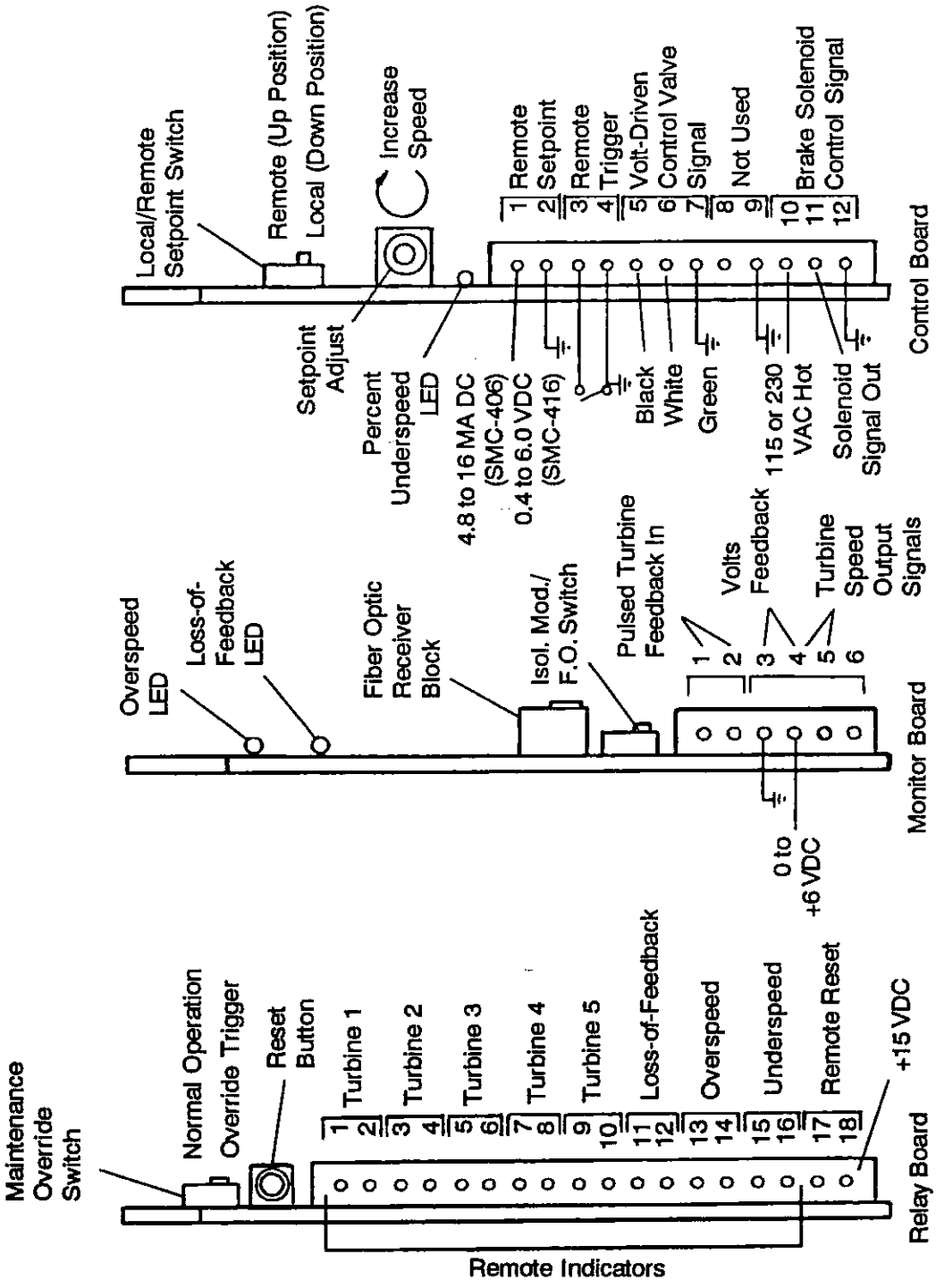

Figure 5. Relay, Monitor, and Control Board Terminals

The following table is useful for determining the proper setpoint voltage:

SMC-416 CONTROL BOARD

Voltage Input (volts) 0-6 VDC		*Speed (RPM)
0.40	(minimum level)	4,000
1.00		10,000
2.00		20,000
3.00		30,000
4.00		40,000
5.00		50,000
6.00	(maximum level)	60,000

*All speeds are ±1% of full scale.

A voltage setpoint input signal of more than 6 volt DC to terminal 1 of the control board will not raise the setpoint above 60,000 RPM. A voltage setpoint input signal of less than 0.40 volts DC may cause the loss-of-feedback circuit to indicate a fault condition and require an operator reset. To avoid incorrect fault conditions, limit the input levels electronically to provide at least 0.40 volts DC. Remote setpoint controls can be provided with a separate control for each turbine or one control for all turbines.

Remote Trigger Input

Terminals 3 and 4 on the control board are used for trigger control. A remote toggle switch, programmable logic controller, contact closure, opto isolator, or similar device can be connected to these terminals to provide remote actuation of the Aerobell turbines.* Each turbine must be individually triggered ON or OFF when remote triggering is used.

Maintenance Override Input

Located on the relay board is a slide switch; this is the maintenance override switch. This switch triggers all control boards in the rack simultaneously. It is intended for system setup and maintenance only.

* The control format is grounding contact between terminal 3 and terminal 4 (ground).

WARNING

THE MAINTENANCE OVERRIDE SWITCH OVERRIDES ANY AND ALL REMOTE TRIGGER SWITCHES OR INPUTS. NEVER SWITCH THE MAINTENANCE OVERRIDE SWITCH TO THE ON POSITION WHEN PERSONNEL ARE IN THE SPRAY BOOTH. TURNING ON THE MAINTENANCE OVERRIDE SWITCH MAY CAUSE SERIOUS PERSONAL INJURY.

The hookup of a remote trigger to terminals 3 and 4 of the control board does not completely disable the maintenance override switch on the relay board. Even if a remote hookup has been made, moving the maintenance override switch to the ON position will still trigger all of the turbines.

Remote Reset

For units shipped before June 1989, a remote reset can be made by closing a contact set across terminals 17 and 18 of the relay board. This resets the latches on all monitor and control boards.

For units shipped after June 1989, a remote reset can be made by closing a contact set across terminals 17 and 18 of the relay board or a 12 or 24 volt DC signal directly to pin 17. This resets the latches on all monitor and control boards.

Local Reset

A local reset can be made by pressing the green reset switch button on the relay board. This switch button is available with the front panel open or closed, and resets the latches on all monitor and control boards.

Remote Indicators

Remote fault indicator lamps or alarm signals may be connected to terminals 1 through 16 on the relay board, Figure 5. The normally open contacts of the feedback, overspeed, underspeed, and turbine relays are connected to these terminals. Each relay will carry a maximum of 120 volts AC, 5 amps, under normal load conditions. Avoid subjecting these relays to severe surges in voltage or current demands. These relays provide a contact closure when a related fault condition occurs. The remote fault indicator or alarm system must include a separate power source.

SPECIFICATIONS

Dimensions of Card Cage:

Height - 8.25 in. (209.6 mm)
Width - 19.00 in. (482.6 mm)
Depth - 10.00 in. (254 mm)

Weights per Channel:

SMC-501 - 18.17 lbs (39.97 kg)
SMC-507 - 3.03 lbs (6.66 kg)
SMC-508 - 3.03 lbs (6.66 kg)
SMC-503 - 12.74 lbs (28.03 kg)
SMC-503A - 12.74 lbs (28.03 kg)
SMC-505 - 12.74 lbs (28.03 kg)
SMC-505A - 12.74 lbs (28.03 kg)

Power Input Requirements:

Voltage - 115/230 volts AC, 50/60 Hz
Voltage - 100/200 volts AC, 50/60 Hz

Current - 1 ampere

Power Output:

Maximum - 250 milliamps at 15 volts DC per SMC-503/505 or SMC-503A/505A Control Package

INSTALLATION

⚠ DANGER

Electric shock hazard. Insulating sheets have been placed over the solder joints on various locations of the relay circuit board. These insulating sheets will prevent electrical shock in event of accidental contact. Never remove these insulating sheets. Never operate the monitor if the insulating sheets have been removed or damaged. Wet hands, high humidity, jewelry, or other metal objects can increase the likelihood of a hazard.

WARNING

IF IMPROPERLY LOCATED, CERTAIN ELECTRICAL EQUIPMENT WILL BECOME A SOURCE OF IGNITION AND MAY CAUSE FIRE OR EXPLOSION. THE SMC-501 ELECTRONICS PANEL MUST BE LOCATED OUTSIDE CLASS I OR II, DIVISION 1 AND 2 HAZARDOUS AREAS (REFERENCE NFPA NO. 33, LATEST EDITION.).

Electronics Panel Mounting

The PulseTrack electronics panel is designed for wall or rack mounting; two mounting brackets are provided. For wall mounting, bolt the brackets to the cabinet sides, flush with the back of the cabinet, Figure 6. For rack mounting, bolt the brackets to the cabinet sides, flush with the front of the cabinet. The rack mount bracket positions are used when mounting the electronics panel into the optional cabinet or any standard 19 inch rack.

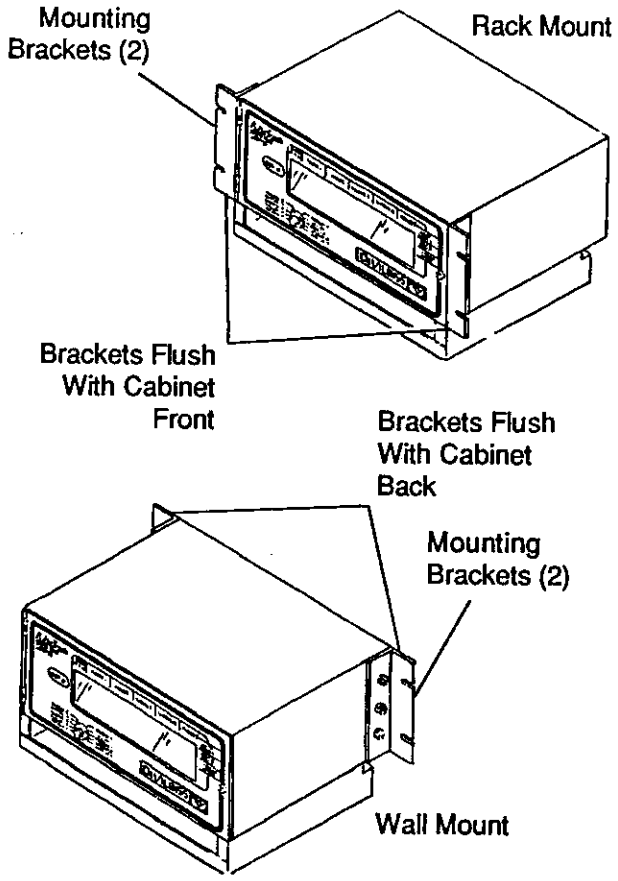

Figure 6. Electronics Panel Mounting

Main AC Voltage Supply

The main disconnect must be fused for 5 amps and grounded to building steel. Grounding between the main disconnect and the electronics panel must also be provided. Minimum input supply wiring must be 16 to 18 gauge stranded, insulated wiring, 600 volt AC, with a green ground wire. All wiring must conform to state and local codes.

1. AC input power lines are connected to screw terminals at the front of the power supply board, Figure 7.

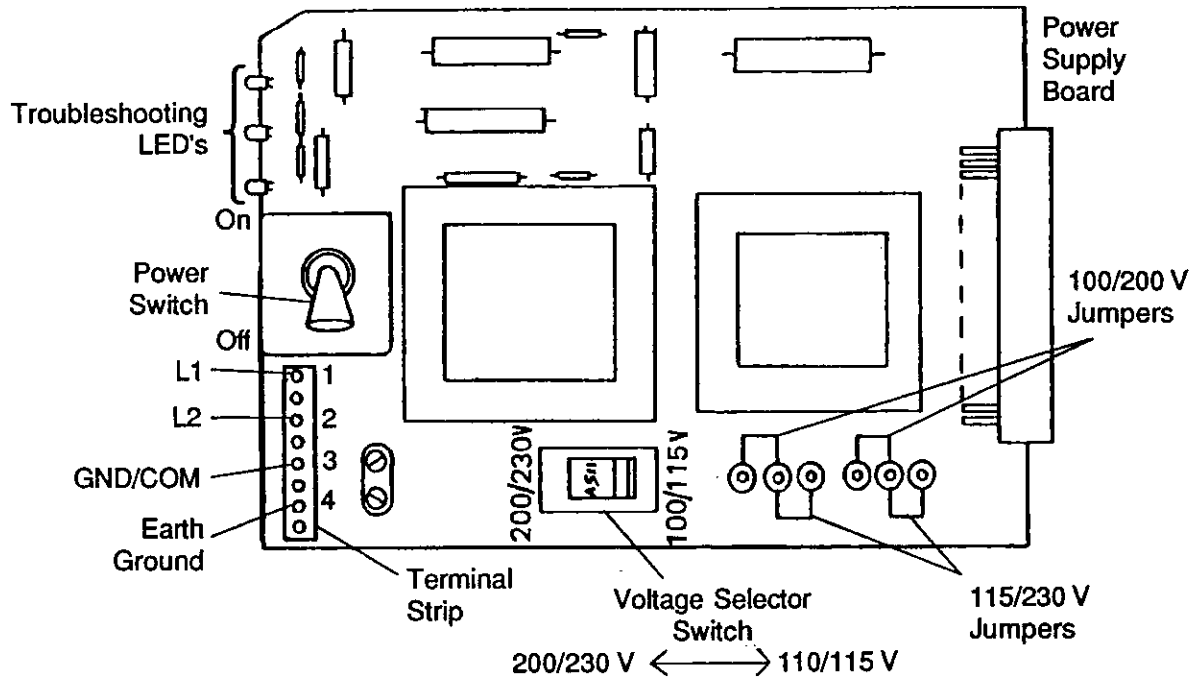

Figure 7. AC Line Connections

2. Connect the AC power lines to terminals L1 and L2 and the ground line to GND/COM. Connect the earth ground to building steel. DO NOT turn the AC power on at this time.

3. Fiber Optic PulseTrack systems are shipped with the voltage selector switch (Figure 7) in the 230 volt position for circuit protection. Select the proper voltage for your installation with the voltage selector switch as follows:

   For either 115 volt/60 Hz or 100 volt/50 Hz - select 115 V.
   For either 230 volt/60 Hz or 200 volt/50 Hz - select 230 V.

4. Fiber Optic PulseTrack systems are shipped with the voltage selector jumpers set up for 115/230 volt AC operation. The positions of the jumpers must be changed for 100/200 volt AC operation. This is a simple adjustment and is indicated on the power supply board. Both jumpers must be set for 115/230 volt AC or 100/200 volt AC.

Monitor Board Setup (Refer to Figure 8)

Monitor Only Systems - Initial Setup:

Loss-of-Feedback Switch - DISABLE
Overspeed Switch - ENABLE
Isolation Module/Fiber Optic Switch - ISOL MOD for Isolation Module Systems or FIBER OPTIC for Fiber Optic Systems

Monitor and Control Systems - Initial Setup:

Loss-of-Feedback Switch - ENABLE
Overspeed Switch - ENABLE
Isolation Module/Fiber Optic Switch - ISOL MOD for Isolation Module Systems or FIBER OPTIC for Fiber Optic Systems

For BEHR Retrofit Systems - Initial Setup:

Overspeed Switch - DISABLE
Other switches same as above.

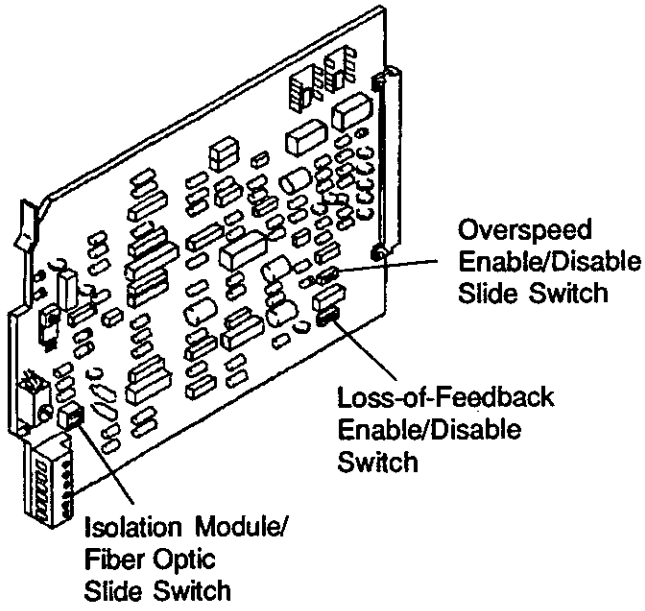

Figure 8. Monitor Board

Fiber Optic Equipment

Fiber optic cables are available in standard 6 foot and 65 foot lengths. Other lengths can be created by using the KK-4913 Fiber Optic Cable Maintenance Kit to either shorten the standard size fiber optic cables or to splice pieces of fiber optic cable to create a longer cable.

Note

Installing splices between fiber optic cables reduces the strength of the light signal being transmitted. When no splices are used, the maximum length of a fiber optic cable is 120 feet. If one splice is used, the total length of the two spliced cables must not exceed 100 feet. If two splices are used, the total length of the three spliced cables must not exceed 80 feet. A fiber optic cable with more than two splices cannot be used with the Fiber Optic PulseTrack system, Figure 9.

Special orders for unusually long, unspliced fiber optic cables may be ordered. Contact your DeVilbiss representative for information.

Note

Fiber optic cable assembly should be treated like a 1/4 inch air tube. A minimum bend radius of 3 inches is required. As with all other air tubing, care must be taken to prevent kinking of the fiber optic cable.

Note

Avoid exposing the ends of fiber optic cables to chemicals such as paint or solvents. Exposing the ends of a fiber optic cable to such chemicals crazes the cable and severely reduces the light signal from the fiber optic transmitter. A cable that has been crazed must be repaired or replaced.

There are two different types of fiber optic transmitters available for use with the Fiber Optic PulseTrack system. They are electrically identical; however, their shape and mounting arrangements are different. One type is used with the RPM Aerobell (Figure 10) and the other with the RMA Aerobell (Figure 12). The two types are not interchangeable, and they are installed into the Fiber Optic PulseTrack system in different ways.

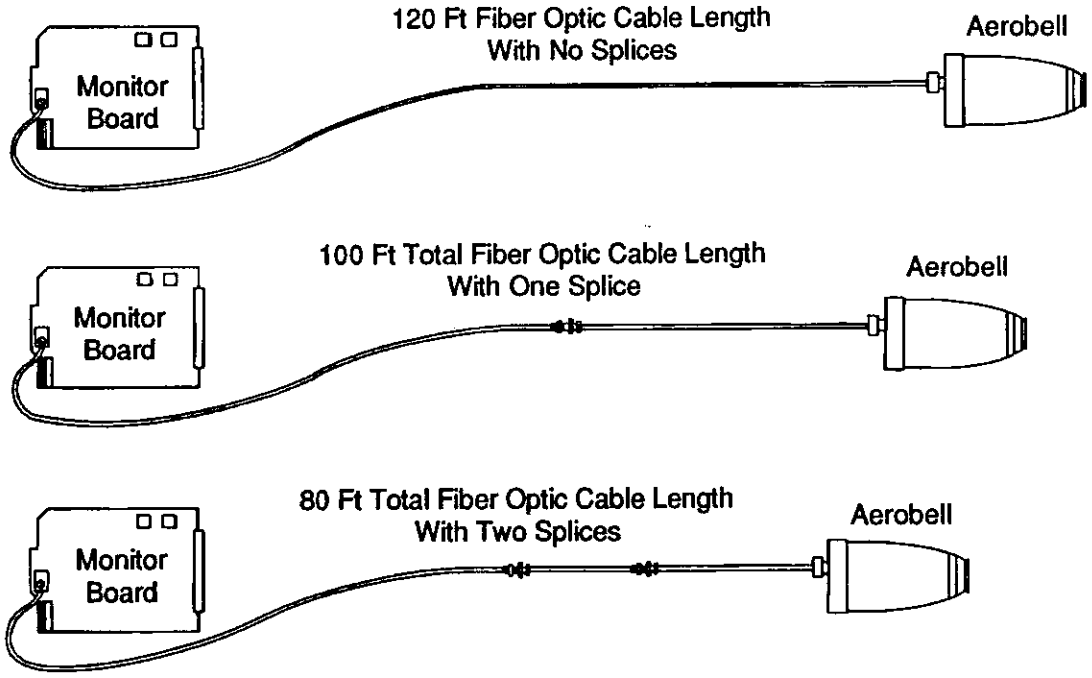

Figure 9. Fiber Optic Cable Splices and Cable Length