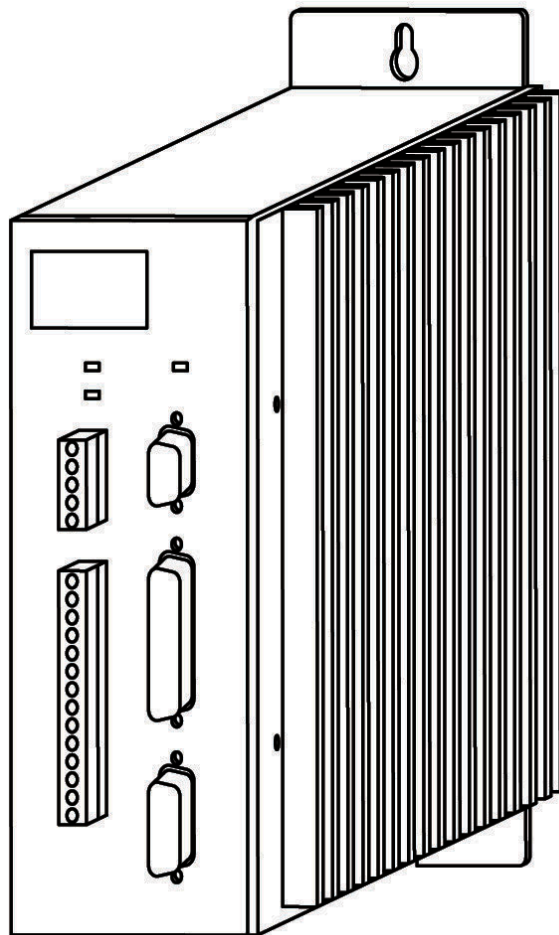

SERVO AMPLIFIER



MODEL: 22-1589

IMPORTANT: Before using this equipment, carefully read SAFETY PRECAUTIONS, starting on page 1, and all instructions in this manual. Keep this Service Manual for future reference.

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SAFETY

SAFETY PRECAUTIONS

Before operating, maintaining or servicing any Ransburg electrostatic coating system, read and understand all of the technical and safety literature for your Ransburg products. 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.

A **WARNING!** states information to alert you to a situation that might cause serious injury if instructions are not followed.

A **CAUTION!** states information that tells how to prevent damage to equipment or how to avoid a situation that might cause minor injury.

A **NOTE** is information relevant to the procedure in progress.

While this manual lists standard specifications and service procedures, some minor deviations may be found between this literature and your equipment. Differences in local codes and plant requirements, material delivery requirements, etc., make such variations inevitable. Compare this manual with your system installation drawings and appropriate Ransburg equipment manuals to reconcile such differences.

Careful study and continued use of this manual will provide a better understanding of the equipment and process, resulting in more efficient operation, longer trouble-free service and faster, easier troubleshooting. If you do not have the manuals and safety literature for your Ransburg system, contact your local Ransburg representative or Ransburg.



WARNING


> The user **MUST** read and be familiar with the Safety Section in this manual and the Ransburg safety literature therein identified.


> This manual **MUST** be read and thoroughly understood by **ALL** personnel who operate, clean or maintain this equipment! Special care should be taken to ensure that the **WARNINGS** and safety requirements for operating and servicing the equipment are followed. The user should be aware of and adhere to **ALL** local building and fire codes and ordinances as well as **NFPA 33 SAFETY STANDARD, 1995 EDITION**, prior to installing, operating, and/or servicing this equipment.



WARNING

> The hazards shown on the following page may occur during the normal use of this equipment. Please read the hazard chart beginning on page 2.W A

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area 	<p>Fire Hazard</p> <p>Improper or inadequate operation and maintenance procedures will cause a fire hazard.</p> <p>Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation. Frequent power supply shutdown indicates a problem in the system requiring correction.</p>	<p>Fire extinguishing equipment must be present in the spray area and tested periodically.</p> <p>Spray areas must be kept clean to prevent the accumulation of combustible residues.</p> <p>Smoking must never be allowed in the spray area.</p> <p>The high voltage supplied to the atomizer must be turned off prior to cleaning, flushing or maintenance.</p> <p>When using solvents for cleaning:</p> <p>Those used for equipment flushing should have flash points equal to or higher than those of the coating material.</p> <p>Those used for general cleaning must have flash points above 100°F (37.8°C).</p> <p>Spray booth ventilation must be kept at the rates required by NFPA 33, 2000 Edition, OSHA and local codes. In addition, ventilation must be maintained during cleaning operations using flammable or combustible solvents.</p> <p>Electrostatic arcing must be prevented.</p> <p>Test only in areas free of combustible material.</p> <p>Testing may require high voltage to be on, but only as instructed.</p> <p>Non-factory replacement parts or unauthorized equipment modifications may cause fire or injury.</p> <p>If used, the key switch by-pass is intended for use only during set-up operations. Production should never be done with safety interlocks disabled.</p> <p>Never use equipment intended for use in waterborne installations to spray solvent based materials.</p>

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
General Use and Maintenance	<p>Improper operation or maintenance may create a hazard.</p> <p>Personnel must be properly trained in the use of this equipment.</p>	<p>Personnel must be given training in accordance with the requirements of NFPA-33, Chapter 16, 1995 edition.</p> <p>Instructions and safety precautions must be read and understood prior to using this equipment.</p> <p>Comply with appropriate local, state, and national codes governing ventilation, fire protection, operation maintenance, and housekeeping. OSHA references are Sections 1910.94 and 1910.107. Also refer to NFPA-33, 1995 edition and your insurance company requirements.</p>
Electrical Equipment 	<p>High voltage equipment is utilized. Arcing in areas of flammable or combustible materials may occur. Personnel are exposed to high voltage during operation and maintenance.</p> <p>Protection against inadvertent arcing that may cause a fire or explosion is lost if safety circuits are disabled during operation.</p> <p>Frequent power supply shut-down indicates a problem in the system which requires correction.</p> <p>An electrical arc can ignite coating materials and cause a fire or explosion.</p>	<p>The power supply, optional remote control cabinet, and all other electrical equipment must be located outside Class I or II, Division 1 and 2 hazardous areas. Refer to NFPA No. 33, 1995 Edition.</p> <p>Turn the power supply OFF before working on the equipment.</p> <p>Test only in areas free of flammable or combustible material.</p> <p>Testing may require high voltage to be on, but only as instructed.</p> <p>Production should never be done with the safety circuits disabled.</p> <p>Before turning the high voltage on, make sure no objects are within the sparking distance.</p>

INTRODUCTION

(For a General Description, Features, and Specifications, Reference GE Fanuc S2K Series Standalone Motion Controller User's Manual, GFK-1848)

SERIAL AND NETWORK COMMUNICATION PORTS

Summary of DIP Switch Functions

Refer to the S2K Hardware Manual for an explanation of the DIP Switch functions. Set the DIP Switches for Device Net Address and baud rate if used.

Serial Port

The S2K includes a serial port that is used to set the operational parameters. The serial port is an RS-232 port designed to operate a 7 data bits, 1 stop bit, and odd parity.

A typical 2 conductor shielded cable can be used to communicate to the S2K amplifier. The connectors are the standard 9-pin D-Sub connector style. The wiring is a straight through style where the shield is connected to pin 5 of both D-Sub connectors. The red wire is connected to pin 3 and the black wire is connected to pin 2 of both connector ends. Refer to the Hardware Manual (GE Fanuc, S2K Series Manual) for additional wiring information.

Cable Length Maximum

Communication cables exceeding 30 meters in length must be enclosed in grounded metal conduit.

ESTABLISH COMMUNICATION TO

AMPLIFIER

(For a General Description of programming protocol, reference GE Fanuc Generation D Real-Time Operating System Programming Manual, GFK-2205.)

Cable Connection

Connect the serial cable to the serial port on the S2K amplifier and tighten screws to fasten the connector. Connect the opposite end of serial cable into the RS-232 serial communication port of computer. Tighten the screws to fasten the connector.

Install Operating Software

The operating software for this amplifier is proprietary of GE Fanuc. The operating software is titled "CCS Win32." Insert CCS Win32 CD into computer and install. Follow typical Window installation methods.

Communicating to Amplifier

1. Open CCS
2. From Terminal window, select Options/Communication Setup
3. Select Serial Communication
4. Select the appropriate COM Port setting
5. Leave Baud Rate set to its default value of 9600
6. Click OK
7. Select Options/Controller Settings
8. Select Serial as the Communication Type
9. Select S2K as the Controller Type
10. Click OK
11. Press enter and the S2K will sign on.

CONNECT AND CONFIGURE AMPLIFIER

Amplifier Termination

- Complete the motor, power, and I/O wiring to the S2K Amplifier. (Reference system prints and GE Fanuc Manual.)
- Maximum encoder cable length is 15 meters using factory supplied cables.
- Maximum resolver cable length is 50 meters using factory supplied cables.
- Positive feedback cables exceeding 30 meters in length must be enclosed in grounded metal conduit.
- Reference system drawings for specific application terminations.
- Operation with a Pulse Source or Operation with an Analog Input voltage can also be used for reference.
- Jumper ENABLE to Common if using internal 12- volt supply or to your external supply common. Jumper ENABLE + to + voltage if using internal +12 Volt supply or to your external supply + voltage. (Reference the system drawings as this Enable signal may already be terminated.)

Enable the Drive

Close the Enable switch from your external device to clear the fault condition. The digital status LED on the front of the S2K will change to OK. By toggling this Enable bit, it will allow the operator to clear faults and enter programs during the programming mode.

DOWNLOADING PROCEDURE

Summary of Downloading Procedure
(Refer to the GE Fanuc Generation D Real-Time Operating System Programming Manual, GFK-2205 for further explanation.)

- Type STF (Set Fault, faults program)
- Type KLALL (Kill All, halts programs which enables programs to be up or down loaded.)
- Type UPS=O (UPS must be set to its default value of zero before CLM command will function.)
- Type CLM (Clear Memory) Are your sure you want to clear all the user memory and reset the registers to their default valves?
- Type Y (Yes) (User memory cleared.)
- Click Tools/Send Files
- Select program to download
- Do you wish to save Programs and Motion Blocks? Click on Yes
- Type Yes (Then the screen will tell you that the user memory has been saved.)
- Click OK or OPEN

Program is in the form of a text file and will be downloaded to the Amplifier.

INSTALLATION

SETUP AND OPERATION

Summary of Dip Switch Functions

(Refer to the S2K Hardware Manual for an explanation of the DIP Switch functions. Reference the system prints for the correct settings.)

Software Programmable Parameters

The SMD emulator program in the S2K allows all of the original SMD parameters to be set in software in the S2K. Following is a list of the parameters. These parameters must be set with the power ON, but with the Enable input set to OFF.

To Query a parameter, type (addr) variable?<Enter>where<Enter>is the Enter key on your terminal.

For example: 1VI1?<Enter>will report the mode: 0=pulse input, 1=analog input.

To set a parameter, type (addr) variable = <Enter>where<Enter>is the Enter key on your terminal.

For example: 1PLA=512<Enter>sets the gear ratio to 1:1.

DEFAULT PROGRAMMABLE PARAMETERS				
Parameter	Function	Minimum	Maximum	Default
PLA	Sets gear ratio	512 = 1:1	5120 = 1:1	512
VI1	Control mode	0 = Pulse	1 = Analog	1
VI4	Direction	0 = CW	1 = CCW	0
VF10	Analog input zero	-10.0	+10.0	0.0
VF11	Analog input full scale	+2.0	+10.0	+10.0
VF12	Output shaft speed scale factor, rpm/volt	10.0	25.0	15.0
VF13	Accel time constant, milleseconds	2	100	22
VF14	Maximum motor current, amps	0.5	3.0	3.0
VF15	Control stiffness, %	25	200	100
VF16	Torque to Inertia ratio	330	60000	3000
VF18	Maximum shaft output speed, rpm	10	255	150
VF19	Analog input time constant			4

The above parameters are the factory default setting and any modifications must be programmed. Proceed to Program Modes.

Figure 2: Default Programmable Parameters Table

PROGRAM MODES

Operation With A Pulse Source

Complete a motor, power, and I/O wiring to the terminal block. When wiring for pulse and direction, Channel A is the pulse input and Channel B is the direction input. Apply a source of 115 VAC to the IMJ. Connect the S2K serial port to a personal computer or other serial terminal device. Refer to the S2K Hardware Manual for serial port wiring and Serial Port. (Refer to Page 4) Configure your serial terminal for 9600 baud, 7 data bits, 1 stop bit, and odd parity. Verify that the serial port is working by typing 1FC?<Enter> and observe the response. Then proceed with the following:

- Type STF<CR>, the controller will respond
“*”
- Type KLALL<CR>, the controller will respond
“*”
- Type VI1=0<CR>, the controller will respond
“*”
- Type VF10 through VF18 to the appropriate values. (The factory supplied default values should work for most applications. Contact Ransburg if there are any questions about what values should be entered.) (Refer to Figure 3)
- Select desired PLA to correspond to the required gear ratio.
- Type SAVE, the controller will respond, “Saving user memory... User memory saved.”
- Once all parameters have been set, type EXP1, the controller will respond, “Variables have been saved to flash memory.”

This indicates that all variables, registers, and programs have been saved. To start the motor, cycle the “Enable” input from false to true.

- Toggle the “Enable” signal.

The S2K will rotate the motor in synchronism with the input pulse source. In this mode, the motor displacement is proportional to the number of pulses received, and motor speed is proportional to the frequency of the pulse train.

The following table represents typical Pulse Source setup parameters. However, depending on the vintage of the system that this amplifier is being retrofitted to, the following parameters could be different:

- VI1 should be setup to a value of 0, (VI1 tells the amplifier how to function, in either pulse mode or analog mode).
- VI4 should be set to 0, but a verification of direction may be required and a setting of 1 may be required in some applications (VI4 tells the amplifier what direction the motor is to be running).
- VF18 should be set for 150, but an older vintage system may require a setup of 120 (VF18 tells the amplifier what the maximum shaft output speed is to be).

DEFAULT PULSE MODE PROGRAMMABLE PARAMETERS CHART				
Parameter	Function	Minimum	Maximum	Default
PLA	Sets gear ratio	512 = 1:1	5120 = 10:1	512
VI1	Control mode	0 = Pulse	1 = Analog	0
VI4	Direction	0 = CW	1 = CCW	0
VF10	Analog input zero	-10.0	+10.0	+0.0
VF11	Analog input full scale	+2.0	+10.0	+10.0
VF12	Output shaft speed scale factor, rpm/volt	10.0	25.0	15.0
VF13	Accel time constant, milliseconds	2	100	22
VF14	Maximum motor current, amps	0.5	3.0	3.0
VF15	Control stiffness, %	25	200	100
VF16	Torque to Inertia ratio	330	60000	3000
VF18	Maximum shaft output speed, rpm	10	255	150/120
VF19	Analog input time constant			4

Figure 3: Default Pulse Mode Programmable Parameters Table

Operation With An Analog Input Voltage

Complete the motor, power, and I/O wiring to the S2K and wire the analog control voltage to analog input terminals AI+, AI-, and ACOM on the screw terminal block. Apply a source of 115 VAC to the IMJ and set VI1 = 1. Set PLA, VI4, and VF10 through VF18 to appropriate values. (The factory supplied default values should work for most applications.) Cycle the Enable input from False to True. When the Run Input on I/O terminal is True, the S2K will accelerate and rotate the motor at a speed proportional to the analog input voltage.

Analog Input Calibration Sequence

1. Connect the S2K analog input to the device producing the motor speed control voltage. If the rest of the system wiring is not in place, connect the S2K power input terminals to a source of 90 to 130 VAC. Disable (turn OFF) the Enable input.
2. Connect the S2K port to a personal computer or other serial terminal device. (Refer to the S2K Hardware Manual for serial port wiring.) Configure

your serial terminal for 9600 baud, 7 data bits, 1 stop bit, and odd parity. Verify that the serial port is working by typing 1FC?<Enter> and observing the response.

3. If changes need to be made to any of the parameters, the following procedure MUST be done:

- Type STF<CR>, the controller will respond “*”
- Type KLALL<CR>, the controller will respond “*”
- Type VI1=1<CR>, the controller will respond “*”

! Type VF10 through VF18 to the appropriate values. (The factory supplied default values should work for most applications. Contact Ransburg if there are any questions about what values should be entered.) (Reference Figure 4)

- Select desired PLA to correspond to the required gear ratio.
- Type SAVE, the controller will respond, "Saving user memory... User memory saved."

This indicates that all variables, registers, and programs have been saved.

- Once all parameters have been set, type XPI, the controller will respond, "Variables have been saved to flash memory."
- To start the motor, cycle the "Enable" input from False to True.

This completes the Analog Input Calibration sequence. All of the parameters are automatically saved to memory as soon as they are entered. The following table represents a typical Analog Source setup parameters.

DEFAULT ANALOG MODE PROGRAMMABLE PARAMETERS CHART				
Parameter	Function	Minimum	Maximum	Default
PLA	Sets gear ratio	512 = 1:1	5120 = 10:1	512
VI1	Control mode	0 = Pulse	1 = Analog	1
VI4	Direction	0 = CW	1 = CCW	0
VF10	Analog input zero	-10.0	+10.0	0
VF11	Analog input full scale	+2.0	+10.0	+10.0
VF12	Output shaft speed scale factor, rpm/volt	10.0	25.0	15.0
VF13	Accel time constant, milliseconds	2	100	22
VF14	Maximum motor current, amps	0.5	3.0	3.0
VF15	Control stiffness, %	25	200	100
VF16	Torque to Inertia ratio	330	60000	3000
VF18	Maximum shaft output speed, rpm	10	255	150
VF19	Analog input time constant			4

Figure 4: Default Analog Mode Programmable Parameters Table

RETROFIT KIT (78694), RCS AMPLIFIER RETROFIT

Retrofit Kit Description

This Retrofit Kit enables the end user to upgrade to the current level of amplifier. Retrofit Kit (78694) allows the end user the backward compatibility option to utilize the GE Fanuc Amplifier in their existing systems. The older Whedco Amplifier can be removed and this Retrofit Kit along with the new GE Fanuc Amplifier will mount in the same location. In other words, the GE Fanuc Amplifier along with the Retrofit Kit (78694) will allow for a direct drop in replacement to the Whedco style manufactured amplifier.

There are two versions of the Retrofit Kit (See Figures 7 and 8), reference this information as

to the proper implementation of the Retrofit Kit.

Retrofit Kit Termination Description

The following tables illustrate the terminal designations and descriptions for each application possible. Reference Retrofit Kit (78694-02) Pulse Mode Operation (See Figure 7) and Retrofit Kit (78694-01) Analog Mode Operation (See Figure 8 for the proper termination and description of individual applications.)

S2K RETROFIT KIT TRANSITION BOARD TERMINAL DESCRIPTIONS				
S2K Retrofit Terminal Block	I.D.	Signal Description	Color Amplifier Signal Description	Hardener Amplifier Signal Description
1	AI+	Analog +	DAC A+	DAC B+
2	ACOM	DC Common	DC Common	DC Common
3	N.C.	(Not Used)	(Not Used)	(Not Used)
4	A-	Channel A-	Freq. Out from MCM	Freq. Out from MCM
5	B-	Channel B-	MON/OFF A+	MON/OFF B+
6	GND	DC Common	DC Common	DC Common
7	EN-	Enable -	Enable -	Enable -
8	OK-	OK -	CLR AMP FAULT	HD AMP Fault
9	N.C.	(Not Used)	(Not Used)	(Not Used)
10	R2	Motor Resolver	Motor Resolver	Motor Resolver
11	S3	Motor Resolver	Motor Resolver	Motor Resolver
12	S4	Motor Resolver	Motor Resolver	Motor Resolver
13	GND/ SHLD	Motor Thermal O.L. Gnd.	Motor Thermal O.L. Gnd.	Motor Thermal O.L. Gnd.

Figure 5: S2K Retrofit Kit Transition Board Terminal Description Table

S2K RETROFIT KIT TRANSITION BOARD TERMINAL DESCRIPTIONS (Cont.)				
S2K Retrofit Terminal Block	I.D.	Signal Description	Color Amplifier Signal Description	Hardener Amplifier Signal Description
14	AI-	Analog-	DAC A-	DAC B-
15	N.C.	(Not Used)	(Not Used)	(Not Used)
16	N.C.	(Not Used)	(Not Used)	(Not Used)
17	N.C.	(Not Used)	(Not Used)	(Not Used)
18	N.C.	(Not Used)	(Not Used)	(Not Used)
19	PULS OUT	N.FREQ.	N. FREQ.A	N.FREQ.B
20	EN+	Enable +	Enable +	Enable +
21	OK+	OK +	24 VDC	24VDC
22	R1	Motor Resolver	Motor Resolver	Motor Resolver
23	S1	Motor Resolver	Motor Resolver	Motor Resolver
24	S2	Motor Resolver	Motor Resolver	Motor Resolver
25	THRM	Motor Thermal O.L.	Motor Thermal	Motor Thermal
26	N.C.	(Not Used)	O.L. (Not Used)	O.L. (Not Used)

Reference Figure 5 for the signal description of the terminations of the Retrofit Kit. Further explanation of these signals can be obtained by referencing the User's Manual for the Raio Control Module 22-461 (Doc. 122-63).

Figure 5: S2K Retrofit Kit Transition Board Terminal Description Table (Cont.)

Reference the S2K Retrofit Kit Transition Board Terminal Description for the signal description of the terminations of the Retrofit Kit. Further explanation of these signals can be obtained by referencing the User's Manual for the Ratio Control Module 22-461 (Doc. 122-63).

S2K Retrofit Kit Transition Board Terminals

TB1	TB2	D - Sub Connector	
	1		
14	AI+	13	1
AI-	ACOM	14	2
N.C.	N.C.	15	3
N.C.	A-	16	4
N.C.	B-	17	5
N.C.	GND	18	6
PLS OUT	EN-	19	7
EN+	OK-	20	8
OK+	N.C.	21	9
R1	R2	22	10
S1	S3	23	11
S2	S4	24	12
	GND	25	
	/		
THRM	SHLD		
N.C.			
26	13		

Figure 6: S2K Retrofit Kit Transition Board Terminals (78653) Table

RETROFIT KIT (78694-02) PULSE MODE OPERATION

This kit is used in RCS Systems that utilize the Motor Control Modules (MCM 22-556). Reference the following table for information on how to terminate the Retrofit Kit (78694-02). Wire numbers have been denoted to illustrate the typical wire numbering used. Reference the system prints for the correct wire number donotation.

TB1	Description	Typical Wire # Color / Hard	TB2	Description	Typical Wire # Color / Hard
14			1		
AI-	N.U		AI+	N.U	
N.C.	N.U.		ACOM	N.U.	
N.C.	N.U.		N.C.	N.U.	
N.C.	N.U.		A-	CHANLA-	4021 / 4070
N.C.	N.U.		B-		
PLS OUT	N.FREQ.		GND	DC COMMON	1071
	A/B	4028 / 4089	EN-	AMP RESET	4143
EN+	24 VDC	1260	OK-	AMP FAULT	X22 / X23
OK+	24 VDC	1260	N.C.		
R1	R1	4030 / 4091	R2	R2	4031 / 4092
S1	S1	4032 / 4093	S3	S3	4033 / 4094
S2	S2	4034 / 4095	S4	S4	4035 / 4096
THRM	THRM	4051 / 4111	GND/ SHLD	GND	4052 / 4112
N.C					
26			13		

Figure 7: S2K Retrofit Kit - Pulse Mode

RETROFIT KIT (78694-01) ANALOG MODE OPERATION

This kit is used in RCS Systems that use the UL Listed and non-UL Listed Whedco Amplifiers (22-1589). Reference Figure 8 for information on how to terminate the Retrofit Kit (78694-01).

Wire numbers have been denoted to illustrate the typical wire numbering used. Reference the System prints for the correct wire number denotation.

TB1	Description	Typical Wire # Color / Hard	TB2	Description	Typical Wire # Color / Hard
14			1		
AI-	DAC - (A/B)	4011 / 4101	AI+	DAC + (A/B)	4020 / 4110
N.C.	N.U.		ACOM	DC COMMON	1071
N.C.	N.U.		N.C.	N.U.	
N.C.	N.U.		A-	N.U.	
N.C.	N.U.		B-	MON/OFF (A/B)	4010 / 4100
	N.FREQ.		GND	DC COMMON	1071
PLS OUT	A/B	4028 / 4128	EN-	AMP RESET	4080
EN+	24 VDC	1260	OK-	AMP FAULT	X22 / X23
OK+	24 VDC	1260	N.C.		
R1	R1	4030 / 4130	R2	R2	4031 / 4131
S1	S1	4032 / 4132	S3	S3	4033 / 4133
S2	S2	4034 / 4134	S4	S4	4035 / 4135
THRM	THRM	4051 / 4151	GND/ SHLD	GND	4052 / 4152
N.C.					
26			13		

Figure 8: S2K Retrofit Kit - Analog Mode Operation

GE FANUC S2K AMPLIFIER TERMINATION

S2K Auxiliary I/O Cable Description

The following Tables depict the terminations used for the GE Fanuc S2K Style amplifiers. These show the wiring of post June 2002 systems, where a Retrofit Kit was not required. (Reference documentation Schematic, RCS, 22-1035 (77809), sheet 4 of 8.) (Reference the system prints for the correct wire number denotation.)

This table can be referenced against Ransburg RCS Amplifier Cable (78615) for additional clarification.

S2K RETROFIT KIT TRANSITION BOARD TERMINAL DESCRIPTIONS						
S2K Auxiliary I/O Cable	I.D.	Signal Description	Color Amplifier Signal Description	Color Amplifier Signal Number	Hardener Amplifier Signal Description	Hardner Amplifier Signal Number
1	AI+	Analog +	DAC A+	4020	DAC B+	4110
2		DC Common	DC Common	1071	DC Common	1071
5		Channel B-	MON/OFF A+	4010	MON/OFF B+	4100
6		DC Common	DC Common	1071	DC Common	1071
7		Enable -	Enable -	4080	Enable -	4080
8		OK -	CLR AMP FAULT	X22	HD AMP Fault	X23
14		Analog -	(DAC A-	4011	DAC B-	4101
19		N. FREQ.	N.FREQ. A	4028	N.FREQ. B	4128
20		Enable +	Enable +	1260	Enable +	1260
21		OK +	24 VDC	1260	24 VDC	1260

Figure 9: S2K Auxiliary I/O Cable Table

S2K POSITION FEEDBACK CABLE						
S2K Ausiliary I/O Cable	I.D.	Signal Description	Color Amplifier Signal Description	Color Amplifier Wire Number	Hardener Amplifier Signal Description	Hardener Amplifier Wire Number
1	R1	Mtr. Resolver	Mtr. Resolver	4030	Mtr. Resolver	4130
2	R2	Mtr. Resolver	Mtr. Resolver	4031	Mtr. Resolver	4131
3	S1	Mtr. Resolver	Mtr. Resolver	4032	Mtr. Resolver	4132
4	S3	Mtr. Resolver	Mtr. Resolver	4033	Mtr. Resolver	4133
5	S2	Mtr. Resolver	Mtr. Resolver	4034	Mtr. Resolver	4134
6	S4	Mtr. Resolver	Mtr. Resolver	4035	Mtr. Resolver	4135
7	Thrm	Mtr. Thrm. OL	Mtr. Thrm. OL	4051	Mtr. Thrm. OL	4151
8	GND/ SHLD	MTR. Thrm. OL	MTR. Thrm. OL	4052	MTR. Thrm. OL	4152
9	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD
10	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD
11	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD
12	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD
13	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD
14	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD
15	SHLD	SHLD	SHLD	SHLD	SHLD	SHLD

Figure 10: S2K Position Feedback Cable Table

S2K MOTOR WINDING AND LINE POWER TERMINATIONS				
S2K Contacts	Color Amplifier Signal Description	Color Amplifier Wire Number	Hardener Amplifier Signal Description	Hardener Amplifier Wire Number
GND	GND	GND	GND	GND
T	Mtr. Winding	4063	Mtr. Winding	4163
S	Mtr. Winding	4062	Mtr. Winding	4162
R	Mtr. Winding	4061	Mtr. Winding	4161
GND	GND	GND	GND	GND
L3	120 VAC	2	120 VAC	2
L2	120 VAC	1080	120 VAC	1100
L1	(Not Used)	(Not Used)	(Not Used)	(Not Used)

Figure 11: S2K Motor Winding and Line Power Terminations Table

TROUBLESHOOTING GUIDE

FRONT PANEL LED DIAGNOSTICS

The front panel LED on S2K controllers reports real-time diagnostic as shown in Figure 12.

LED DIAGNOSTIC FAULTS		
Mnemonic	Controller Status	Description
OK	OK	Drive enabled CPU's and operating system functional
CC	Faulted	Motor power clamp over current
DT	Faulted	Drive over temperature
EC	Faulted	Motor power clamp excessive duty cycle
EI	Faulted	Excessive command increment
FE	Faulted	Excess following error
FL	Faulted	Feedback lost (Servo)
LE	Faulted	Lost enable
MT	Faulted	Motor over temperature (Servo only)
OC	Faulted	Motor over current
OV	Faulted	Motor power over voltage
PF	Faulted	Power failure
PO	Faulted	Position register overflow
SF	Faulted	Software fault
UV	Faulted	Motor power under voltage
00-63	OK / Faulted	DeviceNet node address
•	OK / Faulted	Flashing decimal indicates serial communication is occurring.

Fault and status registers are also available to report faults for the system, input, general I/O, axis status, program status, and system status. Those register messages, their causes, and their possible solutions are documented in GE Fanuc manuals, GFK-2205 and GFK-1848.

Figure 12: Diagnostic Faults Table

PARTS IDENTIFICATION

SERVO AMPLIFIER PART NUMBERS	
PART #	DESCRIPTION
22-1589	Amplifier
78694-00	Retrofit Kit
78694-01	Analog Mode - Includes 78652-00 (cable assembly), 78651-00 (mounting plate), and 78653-00 (transition board)
78694-02	Pulse Mode - Includes 78693-00 (cable assembly), 78651-00 (mounting plate), and 78653-00 (transition board)

WARRANTY POLICIES

LIMITED WARRANTY

Ransburg will replace or repair without charge any part and/or equipment that falls within the specified time (see below) because of faulty workmanship or material, provided that the equipment has been used and maintained in accordance with Ransburg's written safety and operating instructions, and has been used under normal operating conditions. Normal wear items are excluded.

THE USE OF OTHER THAN RANSBURG APPROVED PARTS, VOIDS ALL WARRANTIES.

SPARE PARTS: One hundred and eighty (180) days from date of purchase, except for rebuilt parts (any part number ending in "R") for which the warranty period is ninety (90) days.

EQUIPMENT: When purchased as a complete unit, (i.e., guns, power supplies, control units, etc.), is one (1) year from date of purchase. WRAPPING THE APPLICATOR IN PLASTIC, SHRINK-WRAP, ETC., WILL VOID THIS WARRANTY.

FLUID HANDLING: One (1) year from date of purchase (i.e., Totalizer, CCV Valves, etc.).

AIR BEARING ROTATORS: Fifteen thousand (15,000) hours or three (3) years, whichever occurs first. Warranty period begins on the date of purchase.

RANSBURG'S ONLY OBLIGATION UNDER THIS

WARRANTY IS TO REPLACE PARTS THAT HAVE FAILED BECAUSE OF FAULTY WORKMANSHIP OR MATERIALS. THERE ARE NO IMPLIED WARRANTIES NOR WARRANTIES OF EITHER MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. AUTOMOTIVE ASSUMES NO LIABILITY FOR INJURY, DAMAGE TO PROPERTY OR FOR CONSEQUENTIAL DAMAGES FOR LOSS OF GOODWILL OR PRODUCTION OR INCOME, WHICH RESULT FROM USE OR MISUSE OF THE EQUIPMENT BY PURCHASER OR OTHERS.

EXCLUSIONS:

If, in Ransburg's opinion the warranty item in question, or other items damaged by this part was improperly installed, operated or maintained, Ransburg will assume no responsibility for repair or replacement of the item or items. The purchaser, therefore will assume all responsibility for any cost of repair or replacement and service related costs if applicable.

APPENDIX

PAINT AND SOLVENT SPECIFICATIONS

	REA™ / EFM™ EVOLVER	REM™ / M90™	NO. 2 HAND GUN	TURBODISK™	AEROBELL® II*** AEROBELL® AEROBELL® 33 RMA™-101
RECOMMENDED VISCOSITY USING A ZAHN NO. 2	18 TO 30 SEC	18 TO 30 SEC	20 TO 60 SEC	20 TO 60 SEC	20 TO 60 SEC
PAINT ELECTRICAL RESISTANCE**	.1 MΩ TO ∞	.1 MΩ TO ∞	.1 TO 1 MΩ	.1 MΩ TO ∞	.1 MΩ TO ∞
RECOMMENDED DELIVERY (UP TO)	1000 cc/min	1500 cc/min	180 cc/min	1000 cc/min	500 cc/min

GUIDE TO USABLE SOLVENT SELECTION

Chemical Name	Common Name	Category	Flash Point ^{††} (TCC)	*CAS Number	Evap. Rate [†]	Elec. Res.**
DICHLOROMETHANE	Methylene Chloride	Chlorinated Solvents		75-09-2	14.5	HIGH
VM & P NAPHTHA	Naptha	Aliphatic Hydrocarbons	65°F	8030-30-6	10	HIGH
ACETONE		Ketones	-18°F	67-64-1	5.6	LOW
METHYL ACETATE		Esters	90°F	79-20-9	5.3	LOW
BENZENE		Aromatic Hydrocarbons	12°F	71-43-2	5.1	HIGH
ETHYL ACETATE		Esters	24°F	141-78-6	3.9	MEDIUM
2-BUTANONE	MEK	Ketones	16°F	78-93-3	3.8	MEDIUM
ISO-PROPYL ACETATE		Esters	35°F	108-21-4	3.4	LOW
ISOPROPYL ALCOHOL	IPA	Alcohols	53°F	67-63-0	2.5	LOW
2-PENTANONE	MPK	Ketones	104°F	107-87-9	2.5	MEDIUM
METHANOL	Methyl Alcohol	Alcohols	50°F	67-56-1	2.1	LOW
PROPYL ACETATE	n-Propyl Acetate	Esters	55°F	109-60-4	2.1	LOW
TOLUOL	Toluene	Aromatic Hydrocarbons	48°F	108-88-3	1.9	HIGH
METHYL ISOBUTYL KETONE	MIBK	Ketones	60°F	108-10-1	1.6	MEDIUM
ISOBUTYL ACETATE		Esters	69°F	110-19-0	1.5	LOW
ETHANOL	Ethyl Alcohol	Alcohols		64-17-5	1.4	LOW
BUTYL ACETATE		Esters	78°F	123-86-4	1.0	LOW
ETHYLBENZENE		Aromatic Hydrocarbons	64°F	100-41-4	.89	HIGH
1-PROPANOL	n-Propyl Alcohol	Alcohols	74°F	71-23-8	.86	LOW
2-BUTANOL	sec.-Butyl Alcohol	Alcohols	72°F	78-92-2	.81	LOW
XYLOL	Xylene	Aromatic Hydrocarbons	79°F	1330-02-07	.80	HIGH
AMYL ACETATE		Esters	106°F	628-63-7	.67	MEDIUM
2-METHYLPROPANOL	iso-Butyl Alcohol	Alcohols	82°F	78-83-1	.62	LOW
METHYL AMYL ACETATE		Esters	96°F	108-84-9	.50	LOW
5-METHYL-2-HEXANONE	MIAC	Ketones	96°F	110-12-3	.50	MEDIUM
1-BUTANOL	n-Butyl Alcohol	Alcohols	95°F	71-36-3	.43	LOW
2-ETHOXYETHANOL		Glycol Ethers	164°F	110-80-5	.38	LOW
2-HEPTANONE	MAK	Ketones	102°F	110-43-0	.40	MEDIUM
CYCLOHEXANONE		Ketones	111°F	108-94-1	.29	MEDIUM
AROMATIC-100	SC#100	Aromatic Hydrocarbons	111°F		.20	HIGH
DIISOBUTYL KETONE	DIBK	Ketones	120°F	108-83-8	.19	MEDIUM
1-PENTANOL	Amyl Alcohol	Alcohols		71-41-0	.15	LOW
DIACETONE ALCOHOL		Ketones	133°F	123-42-2	.12	LOW
2-BUTOXYETHANOL	Butyl Cellosolve	Glycol Ethers	154°F	111-76-2	.07	LOW
CYCLOHEXANOL		Alcohols	111°F	108-93-0	.05	LOW
AROMATIC-150	SC#150	Aromatic Hydrocarbons	149°F		.004	HIGH
AROMATIC-200		Aromatic Hydrocarbons	203°F		.003	HIGH

* CAS Number: Chemical Abstract Service Number.

** Electrical Resistance using the Ransburg Meter.

*** Solvent Base Configuration Only.

† Information Obtained From: <http://solvdb.ncms.org>

†† The lowest temperature at which a volatile fluid will ignite.

Evaporation Rate is Based Upon Butyl Acetate Having a Rate of 1.0

NOTE: Chart provides resistance and control information that we feel is necessary when using Ransburg equipment.

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FASTEST
 SLOWER

VISCOSITY CONVERSION CHART																	
Poise	Centipoise	DuPont Parlin 7	DuPont Parlin 10	Fisher 1	Fisher 2	Ford Cup 3	Ford Cup 4	Gardner - Holdt Bubble	Gardner - Lithographic Krebs Unit KU	Saybolt Universal SSU	Zahn 1	Zahn 2	Zahn 3	Zahn 4	Zahn 5	Sears Craftsman Cup	Din Cup 4
.1	10	27	11	20			5	A-4		60	30	16					10
.15	15	30	12	25			8	A-3		80	34	17					11
.2	20	32	13	30	15		10			100	37	18					12
.25	25	37	14	35	17		12	A-2		130	41	19					13
.3	30	43	15	39	18		14	A-1		160	44	20					14
.4	40	50	16	50	21		18	A		210	52	22				19	15
.5	50	57	17		24		22			260	60	24				20	16
.6	60	64	18		29		25	B		320	68	27				21	18
.7	70		20		33		28			370		30				23	21
.8	80		22		39		31	C		430		34				24	23
.9	90		23		44		32			480		37				26	25
1.0	100		25		50		34	D		530		41		10		27	27
1.2	120		30		62		41	E		580		49		11		31	31
1.4	140		32				45	F		690		58		13		34	34
1.6	160		37				50	G		790		66		14		38	38
1.8	180		41				54		000	900		74		16		40	43
2.0	200		45				58	H		1000		82		17		44	46
2.2	220						62	I		1100				18			51
2.4	240						65	J		1200				20			55
2.6	260						68			1280				21			58
2.8	280						70	K		1380				22			63
3.0	300						74	L		1475				24			68
3.2	320							M		1530				25			72
3.4	340							N		1630				26			76
3.6	360							O		1730				28			82
3.8	380									1850				29			86
4.0	400							P		1950				30			90
4.2	420									2050				32			95
4.4	440							Q		2160				33			100
4.6	460							R		2270				34			104
4.8	480								00	2380				36			109
5.0	500							S		2480				37			112
5.5	550							T		2660				40			124
6.0	600							U		2900				44			135
7.0	700									3375				51			160
8.0	800								0	3380				58			172
9.0	900							V		4300				64			195
10.0	1000							W		4600							218
11.0	1100									5200							
12.0	1200									5620							

VISCOSITY CONVERSION CHART (Continued)																	
Poise	Centipoise	DuPont Parlin 7	DuPont Parlin 10	Fisher 1	Fisher 2	Ford Cup 3	Ford Cup 4	Gardner - Holdt Bubble	Gardner - Lithographic Krebs Unit	Saybolt Universal SSU	Zahn 1	Zahn 2	Zahn 3	Zahn 4	Zahn 5	Sears Craftsman Cup	Din Cup 4
13.0	1300							X	95	6100					64		
14.0	1400								1	96	6480						
15.0	1500									98	7000						
16.0	1600									100	7500						
17.0	1700									101	8000						
18.0	1800							Y			8500						
19.0	1900										9000						
20.0	2000									103	9400						
21.0	2100										9850						
22.0	2200										10300						
23.0	2300							Z	2	105	10750						
24.0	2400									109	11200						
25.0	2500							Z-1		114	11600						
30.0	3000									121	14500						
35.0	3500							Z-2	3	129	16500						
40.0	4000									133	18500						
45.0	4500							Z-3		136	21000						
50.0	5000										23500						
55.0	5500										26000						
60.0	6000							Z-4	4		2800						
65.0	6500										30000						
70.0	7000										32500						
75.0	7500										35000						
80.0	8000										37000						
85.0	8500										39500						
90.0	9000										41000						
95.0	9500										43000						
100.0	10000							Z-5	5		46500						
110.0	11000										51000						
120.0	12000										55005						
130.0	13000										60000						
140.0	14000										65000						
150.0	15000							Z-6			67500						
160.0	16000										74000						
170.0	17000										83500						
180.0	18000										83500						
190.0	19000										88000						
200.0	20000										93000						
300.0	30000																

Note: All viscosity comparisons are as accurate as possible with existing information. Comparisons are made with a material having a specific gravity of 1.0.

VOLUMETRIC CONTENT OF HOSE OR TUBE (English Units)							
I.D. (inches)	cc/ft.	Cross Section (in. ²)	Length				
			5ft. (60")	10ft. (120")	15ft. (180")	25ft. (300")	50ft. (600")
1/8	2.4	.012	.003 gal. .4 fl. oz.	.006 gal. .8 fl. oz.	.010 gal. 1.2 fl. oz.	.016 gal. 2.0 fl. oz.	.032 gal. 4.1 fl. oz.
3/16	5.4	.028	.007 gal. .9 fl. oz.	.014 gal. 1.8 fl. oz.	.022 gal. 2.8 fl. oz.	.036 gal. 4.6 fl. oz.	.072 gal. 9.2 fl. oz.
1/4	9.7	.049	.013 gal. 1.6 fl. oz.	.025 gal. 3.3 fl. oz.	.038 gal. 4.9 fl. oz.	.064 gal. 8.2 fl. oz.	.127 gal. 16.3 fl. oz.
5/16	15.1	.077	.020 gal. 2.5 fl. oz.	.040 gal. 5.1 fl. oz.	.060 gal. 7.6 fl. oz.	.100 gal. 12.7 fl. oz.	.199 gal. 25.5 fl. oz.
3/8	21.7	.110	.029 gal. 3.7 fl. oz.	.057 gal. 7.3 fl. oz.	.086 gal. 11.0 fl. oz.	.143 gal. 18.4 fl. oz.	.287 gal. 36.7 fl. oz.
1/2	38.6	.196	.051 gal. 6.5 fl. oz.	.102 gal. 13.1 fl. oz.	.153 gal. 19.6 fl. oz.	.255 gal. 32.6 fl. oz.	.510 gal. 65.3 fl. oz.

VOLUMETRIC CONTENT OF HOSE OR TUBE (Metric Units)							
I.D. (mm)	cc/m	Cross Section (mm ²)	Length				
			1.5m	3.0m	4.5m	6.0m	7.5m
3.6	10.2	10.2	15.3 cc	30.5 cc	45.8 cc	61.1 cc	76.3 cc
5.6	24.6	24.6	36.9 cc	73.9 cc	110.8 cc	147.8 cc	184.7 cc
6.8	36.3	36.3	54.5 cc	109.0 cc	163.4 cc	217.9 cc	272.4 cc
8.8	60.8	60.8	91.2 cc	182.5 cc	273.7 cc	364.9 cc	456.2 cc

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Manufacturing
1910 North Wayne Street
Angola, Indiana 46703-9100
Telephone: 260/665-8800
Fax: 260/665-8516

Technical/Service Assistance Telephone: 800/ 233-3366 Fax: 419/ 470-2071

Technical Support Representative will direct you to the appropriate telephone number for ordering Spare Parts.