

SECTION D

ANALOG OUTPUTS

Revision Date: 12-30-22

DESCRIPTION OF OPERATION

Introduction

Analog Outputs AOX1 & AO1 - AO6 are provided to send 4-20mA analog data to external devices such as Variable Frequency Drives or to a Local Level Display or Telemetry device.

The Analog Outputs are Isolated, Transient Protected and use a 12-bit Digital to Analog Converter to produce the reference signal for the 4-20mA Analog Output.

The Analog Outputs are factory calibrated to have the following Analog Output Status values:

819 @ 4.0mA 4095 @ 20mA

For Terminal Block numbers see page D-5.

Functions

Using Parameters F.400 - F.406, each Analog Output must be assigned a Function that determines what data is sent to the Analog Output to control the value of its output. See page D-2 and see "ANALOG OUTPUT FUNCTIONS" below for a description of each of the Functions.

Status

The Analog Outputs Status values may be read from Parameters A.400 - A.406. See page D-2.

Calibration

The Analog Outputs may be re-calibrated in the field using Parameters C.401 - C.414. See pages D-3 & 4.

ANALOG OUTPUT FUNCTIONS

No Function - Function 0

Analog Outputs that are assigned the Function of "No Function" (Function 0), will not perform any Function and will have their output turned off.

Pump 1 - 6 Speed Reference - Functions 1 - 6

Analog Outputs assigned the Functions of "Pump 1 - 6 Speed Reference" (Functions 1 - 6) provide the Speed Reference to Pumps 1 - 6 Variable Frequency Drives.

With these Functions, the Analog Outputs are only active providing the speed reference when the respective pump is called to run. When a pump is not called to run the respective Analog Output sends out 4mA.

With these Functions, a 4mA output represents a speed reference of 0 percent (0Hz) and a 20mA output represents a speed reference of 100 percent (60Hz).

The setting on the "Master Control Mode" (Parameter P.091) (Level Control, Flow Control, Pressure Control or Booster Control) will determine which additional setup parameters must also be setup to control the "Pump 1 - 6 Speed Reference".

Pump X Speed Reference - Function 7

An Analog Output assigned the Function of "Pump X Speed Reference" (Function 7) provides a Speed Reference to any of the pump's Variable Frequency Drives.

With this Function, the Analog Output is always active even if no pumps are called to run.

With this Function, a 4mA output represents a speed reference of 0 percent (0Hz) and a 20mA output represents a speed reference of 100 percent (60Hz).

The setting on the "Master Control Mode" (Parameter P.091) (Level Control, Flow Control, Pressure Control or Booster Control) will determine which additional setup parameters must also be setup to control the "Pump X Speed Reference".

Local Analog Level Display - Function 8

The Analog Output from the "Local Analog Level Display" (Function 8) is a copy of the "Level Input Data" (Parameter Ld.01). It represents the Level currently being used by the Controller to perform Level Control. It provides analog Level data to a Local Analog Level Display or Telemetry Device.

The Span of the Analog Output from Function 8 must match the Span of the external Local Analog Level Display or Telemetry Device. To make them match set the "Local Analog Level Display - Span" (Parameter F.407) so that it matches the Span set on the external Local Analog Level Display or Telemetry Device.

Analog Output Function 8 is only applicable in the "Level Control Mode" (Parameter P.091 = 1).

For more information see Parameter Ld.01 on page 1-8 and Parameter F.407 on page D-2.

ANALOG OUTPUTS

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes		
Parameter	Default Value	Current Value	Register Address			
Analog Output Setup						
Setup				Analog Output	<p>Function of Analog Output:</p> <p>0 = No Function</p> <p>1 = Pump 1 Speed Reference 2 = Pump 2 Speed Reference 3 = Pump 3 Speed Reference 4 = Pump 4 Speed Reference 5 = Pump 5 Speed Reference 6 = Pump 6 Speed Reference 7 = Pump X Speed Reference 8 = Local Analog Level Display</p> <p>Notes:</p> <ol style="list-style-type: none"> The "No Function" (Function 0) turns off the Analog Output. The "Pump 1 - 6 Speed Reference" (Functions 1 - 6) are active only when the respective pump is called to run. The "Pump X Speed Reference" (Function 7) is always active. The "Local Analog Level Display" (Function 8) is a copy of the "Level Input Data". See Parameter F.407 below. 	
F.400	7		40690	Analog Output - AOX1		
F.401	1		40691	Analog Output - AO1		
F.402	2		40692	Analog Output - AO2		
F.403	3		40693	Analog Output - AO3		
F.404	4		40694	Analog Output - AO4		
F.405	5		40695	Analog Output - AO5		
F.406	6		40696	Analog Output - AO6		
F.407	23.1 feet		40697	<p style="text-align: center;">Local Analog Level Display - Span Range: 0.2 - 231.0 feet</p> <p>Note: One of the Controller's Analog Outputs may be assigned to perform the Function of "Local Analog Level Display" (Function 8) which sends the Level Input Data from Parameter Ld.01 to an external 4-20mA device (Local Analog Level Display or Telemetry Device).</p> <p>Parameter F.407 is used to scale the 4-20mA output signal so that the Local Analog Level Display will correctly display the level in feet and 1/10 of feet.</p> <p>The Span of the Analog Output assigned to perform Function 8 must match the Span of the external Local Analog Level Display or Telemetry Device. To make them match set Parameter F.407 so that it matches the Span set on the external Local Analog Level Display or Telemetry Device.</p> <p>This Feature is only applicable in the "Level Control Mode" (Parameter P.091 = 1).</p>		
Analog Output Status						
Status				Analog Output	<p>Note:</p> <p>Parameters A.400 - A.406 provide the status of the control values that are sent to the 12-bit Digital to Analog Converters that provide the reference signals to the Analog Outputs.</p> <p>They are factory calibrated to the following:</p> <p style="text-align: center;">819 @ 4.0mA 4095 @ 20mA</p>	
A.400	-	-	41870	Analog Output - AOX1		
A.401	-	-	41871	Analog Output - AO1		
A.402	-	-	41872	Analog Output - AO2		
A.403	-	-	41873	Analog Output - AO3		
A.404	-	-	41874	Analog Output - AO4		
A.405	-	-	41875	Analog Output - AO5		
A.406	-	-	41876	Analog Output - AO6		

ANALOG OUTPUTS

User / Operator Info.	SCADA	Description of Register Contents		
Parameter	Register Address			
Analog Output Calibration				
C.401	40071	Analog Output (AOX1)	Zero Calibration	Also see the Analog Output - AOX1 Status Parameter A.400.
C.402	40072		Span Calibration	
C.403	40073	Analog Output (AO1)	Zero Calibration	Also see the Analog Output - AO1 Status Parameter A.401.
C.404	40074		Span Calibration	
C.405	40075	Analog Output (AO2)	Zero Calibration	Also see the Analog Output - AO2 Status Parameter A.402.
C.406	40076		Span Calibration	
C.407	40077	Analog Output (AO3)	Zero Calibration	Also see the Analog Output - AO3 Status Parameter A.403.
C.408	40078		Span Calibration	
C.409	40079	Analog Output (AO4)	Zero Calibration	Also see the Analog Output - AO4 Status Parameter A.404.
C.410	40080		Span Calibration	
C.411	40081	Analog Output (AO5)	Zero Calibration	Also see the Analog Output - AO5 Status Parameter A.405.
C.412	40082		Span Calibration	
C.413	40083	Analog Output (AO6)	Zero Calibration	Also see the Analog Output - AO6 Status Parameter A.406.
C.414	40084		Span Calibration	

See page D-4 for Calibration Procedures.

ANALOG OUTPUT CALIBRATION PROCEDURE

Zero Calibration

1. First the respective Analog Output Control Value must be forced to a value of 819.

Using the SC5000-CTS-HMI

When using the SC5000-CTS-HMI, while on the HMI screen for calibration of the output, press the "FORCE 4.0 mA OUTPUT" button.

See example HMI screen on page D-7.

Using the SC5000-LED-HMI

When using the SC5000-LED-HMI, this step is done automatically while viewing (in the menu) the Zero Calibration Parameter (C.401, C.403, C.405, C.407, C.409, C.411 or C.413).

See page X-25.

2. Then using the Zero Calibration Parameter make the measured Analog Output 4.0mA.

Using the SC5000-CTS-HMI

When using the SC5000-CTS-HMI, while on the HMI screen for calibration of the output, increase or decrease the Zero Calibration Parameter (C.401, C.403, C.405, C.407, C.409, C.411 or C.413), using the "+" or "-" buttons until the measured (with an Amp Meter) Analog Output reads 4.0mA.

See example HMI screen on page D-7.

Using the SC5000-LED-HMI

When using the SC5000-LED-HMI, while displaying (in the menu), the Zero Calibration Parameter (C.401, C.403, C.405, C.407, C.409, C.411 or C.413), press the Up or Down pushbuttons until the measured (with an Amp Meter) Analog Output reads 4.0mA.

See page X-25.

Span Calibration

1. First the respective Analog Output Control Value must be forced to a value of 4095.

Using the SC5000-CTS-HMI

When using the SC5000-CTS-HMI, while on the HMI screen for calibration of the output, press the "FORCE 20 mA OUTPUT" button.

See example HMI screen on page D-7.

Using the SC5000-LED-HMI

When using the SC5000-LED-HMI, this step is done automatically while viewing (in the menu) the Span Calibration Parameter (C.402, C.404, C.406, C.408, C.410, C.412 or C.414).

See page X-25.

2. Then using the Span Calibration Parameter make the measured Analog Output 20mA.

Using the SC5000-CTS-HMI

When using the SC5000-CTS-HMI, while on the HMI screen for calibration of the output, increase or decrease the Span Calibration Parameter (C.402, C.404, C.406, C.408, C.410, C.412 or C.414), using the "+" or "-" buttons until the measured (with an Amp Meter) Analog Output reads 20mA.

See example HMI screen on page D-7.

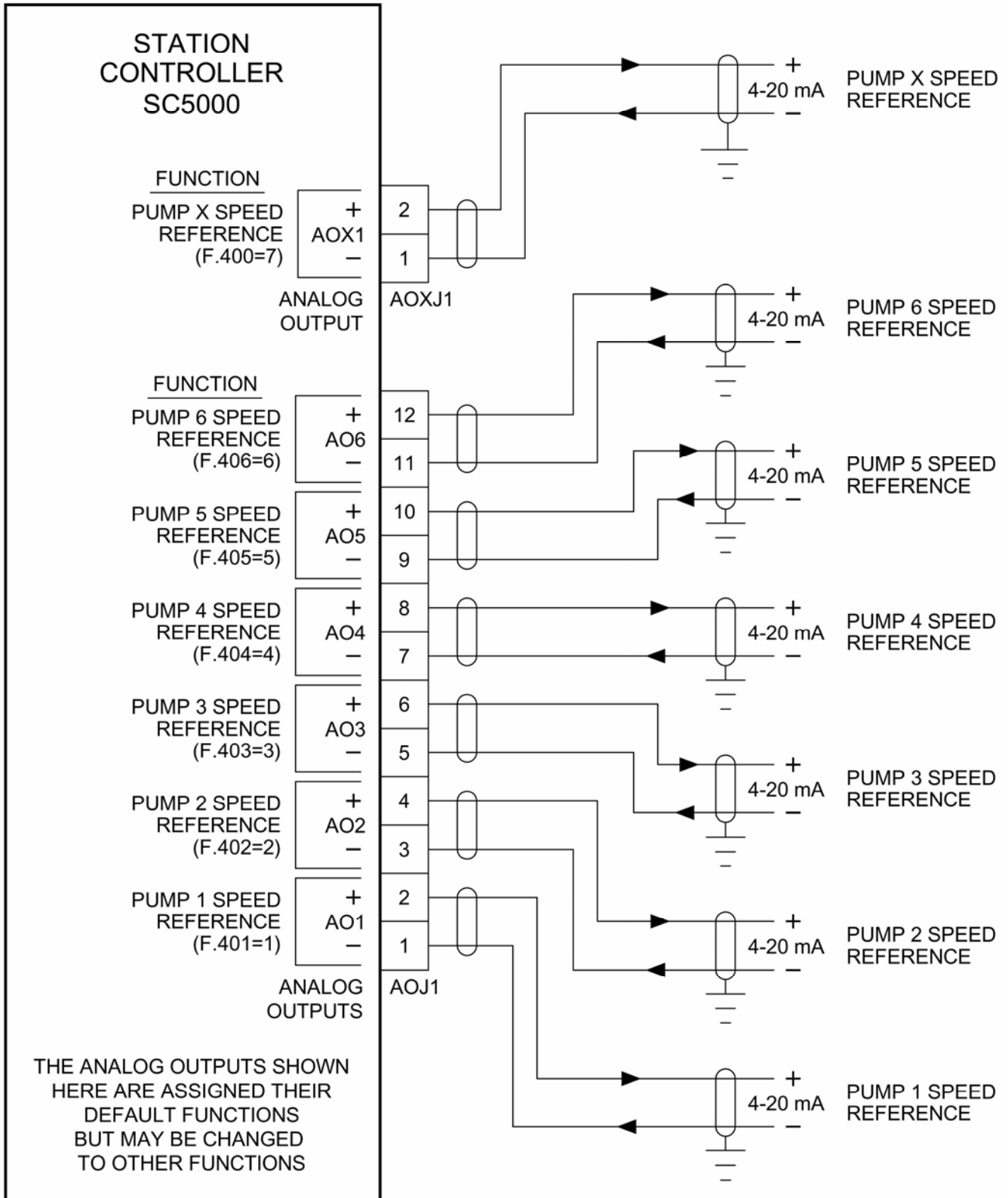
Using the SC5000-LED-HMI

When using the SC5000-LED-HMI, while displaying (in the menu), the Span Calibration Parameter (C.402, C.404, C.406, C.408, C.410, C.412 or C.414), press the Up or Down pushbuttons until the measured (with an Amp Meter) Analog Output reads 20mA.

See page X-25.

ANALOG OUTPUTS

Connection Diagram



ANALOG OUTPUTS - Touchscreen HMI SCREENS

ANALOG OUTPUT SETUP & STATUS

Previous Screen

ANALOG OUTPUT	SETUP	CALIBRATION	STATUS	
AOX1	F.400 - 12	Next Screen	1234	<p>MAIN CONTROL BOARD</p> <p>12345 Operating Program Revision Number Parameter: d.101</p> <p>ANALOG OUTPUT BOARD</p> <p>12345 Operating Program Revision Number Parameter: d.102</p> <p>12345 Polling Counter Parameter: d.103</p> <p>Analog Outputs are Calibrated for: 819 @ 4.00mA 4095 @ 20mA</p>
AO1	F.401 - 12	Next Screen	1234	
AO2	F.402 - 12	Next Screen	1234	
AO3	F.403 - 12	Next Screen	1234	
AO4	F.404 - 12	Next Screen	1234	
AO5	F.405 - 12	Next Screen	1234	
AO6	F.406 - 12 Parameters:	Next Screen	1234 Parameters: A.400 - A.406	<div style="border: 1px solid black; padding: 2px; margin-top: 10px;">Next Screen</div>

LOCAL ANALOG LEVEL DISPLAY SETUP

Previous Screen

Local Analog Level Display - Span

123.4

 feet

Parameter: F.407

This Parameter must be setup whenever an Analog Output is assigned the Function of "Local Analog Level Display" (Function 8) and is used to send the Level Input Data from Parameter Ld.01 to an external Local Analog Level Display or to a Telemetry Device. The scaling of the external device must match what is set on Parameter F.407.

ANALOG OUTPUTS - Touchscreen HMI SCREENS

Analog Output Calibration - Typical of Analog Outputs AOX1 and AO1 - AO6

ANALOG OUTPUT CALIBRATION - AOX1 Previous Screen

ANALOG OUTPUT STATUS AOX1

12345

Parameter: A.400

ZERO - CAL.

+	+	+	+	+
1	2	3	4	5
-	-	-	-	-

Parameter: C.401

FORCE
4.0 mA OUTPUT

SPAN - CAL.

+	+	+	+	+
1	2	3	4	5
-	-	-	-	-

Parameter: C.402

FORCE
20 mA OUTPUT

A.400 - Must be Calibrated to: 4.0mA @ 819 20mA @ 4095