

**Electric Fluid Servo Module**






**AM722-S11**

**User manual**

**IM23H51-E**














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Symbol Definition	
	<b>WARNING:</b> Indicates information that a potentially hazardous situation which, if not avoided, could result in serious injury or death.
	<b>RISK OF ELECTRICAL SHOCK:</b> Indicates information that Potential shock hazard where HAZARDOUS LIVE voltages greater than 30V RMS, 42.4V peak, or 60V DC may be accessible.
	<b>ESD HAZARD:</b> Indicates information that Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices
	<b>ATTENTION:</b> Identifies information that requires special consideration.
	<b>TIP:</b> Identifies advice or hints for the user.

## Security& Caution Symbols

The following table lists Security& Caution symbols used on equipments.

No.	Symbol	Description
1		Direct current (DC)
2		Alternating current (AC)
3		Ground (Earth) terminal
4		Protective earth (ground) terminal
5		Reference ground (Earth) terminal
6		Frame or chassis
7		Equipotentiality
8		On (power)
9		Off (power)
10		Caution, risk of electric shock
11		Caution, hot surface
12		Caution, risk of danger
13		Electrostatic sensitive devices (ESD)

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# Electric Fluid Servo Module AM722-S11

## Section 1 Description

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As a special module in the DEH turbine control system, AM722-S11 composes the electric liquid servo loop with the electric liquid servo valve and LVDT device etc, to control the electric liquid servo valve.

AM722-S11 works with the terminal board TU704-R1100 to compose the DEH electric liquid servo control unit, and it can receive the standard signal or LVDT signal as position feedback, as while receive various auxiliary signals, such as grid connected switch tripping signal and manual increase/decrease by manual instrument. The module can export the current or voltage signal to drive electric fluid servo valve, and drive the adjustment valve on the turbine.

### 1.1 Basic Functions

#### 1.1.1 Servo Control Function

1. Rapid proportional integral control function. The proportional integral control loop can choose two working modes voltage output and current output. The current output signal is in the range of (-20~20) mA, and the voltage output signal is in the range of (-10~10) V.
2. Provide the LVDT signal in the range of (0~20) mA separately, and display the current valve position value.
3. Support the LVDT of six-wire, and can modulate and demodulate the LVDT signal to generate the DC voltage signal of (-5~5) V, and the module can receive the modulated LVDT DC signal of (4~20) mA directly.

#### 1.1.2 Auto/Manual Switching Function

The module provides manual setting function for the electric fluid servo module to guarantee the safety of servo control and protect it from out of working when the controller fault or network fault occurs. The operator can control the output of electric fluid servo module directly by handheld when it is in the mode of manual control.

Auto mode: receive the oil motor valve position signal sent by the controller.

Manual mode: modify the oil motor valve position signal by handheld. The handheld provides increase/decrease signals and each increase/decrease value is a settable parameter which can be set by configuration parameter.

Conditions of switching from auto mode to manual mode:

1. Long-time communication fault: the servo control module switches from auto mode to manual mode when the communication fault between servo control module and controller lasting for

5s.

2. Manual switching by operator: the servo control module switches from auto mode to manual mode when the operator set the auto/manual switching button of the manual instrument as "Manual".

Conditions of switching from manual mode to auto mode:

1. When the module is set from no communication to establish communication and the manual instrument is set as "Auto", if it achieves noninterference switching, the module switches from manual mode to auto mode.
2. When the auto/manual switching button is set as "Auto" and it achieves noninterference switching, the module switches from manual mode to auto mode. While if the module switches to manual mode because of the communication fault with the controller, it cannot be switched to auto mode by the auto/manual switching button.

### 1.1.3 Various DI Signals Functions

1. Grid connected switch tripping function

Connect with the field grid connected switch tripping signal. When the grid connected switch tripping occurs, the module sets the AO signal of electric fluid servo valve as minimum, and the valve position output will be decided by the parameters sent by operator station after it lasting for 2s, and the feedback signals of current LVDT start to be collected.

2. Auto/manual switch

Users can control the auto/manual operation by the auto/manual button of the manual instrument. When the module is set as auto mode, users can control output by controlling the function block variable of the operator station. When the module is set as manual mode, all function block variables are out of work, users can control the output by using the auto/manual increase/decrease button. (Auto/Manual switching only works in parallel network and achieves noninterference, and does not work when out of network.)

3. Manual increase button

Connect with the manual increase button of the manual instrument. It works when the module is in manual mode. The output value increases for each time the button closed. The value can be set by the function block pin STEPRATE. (Button press time  $\geq 200\text{ms}$ , the action works. After pressing for 2s, the servo control module responses to the action for each 100ms.)

4. Manual decrease button

Connect with the manual decrease button of the manual instrument. It works when the module is in manual mode. The output value decreases for each time the button closed. The value can be set by the function block pin STEPRATE. (Button press time  $\geq 200\text{ms}$ , the action works. After pressing for 2s, the servo control module responses to the action for each 100ms.)

### 1.1.4 Auto Zero-adjust and Amplitude-adjust Function

The module provides zero-adjust and amplitude-adjust function, including auto zero-adjust and amplitude-adjust function and manual zero-adjust and amplitude-adjust, to guarantee the consistency between the route indication of oil motor and the jaw opening of the actual adjusting valve.

Auto zero-adjust and amplitude-adjust function process instruction:

1. Install the LVDT displacement sensor to a proper position in application. Make sure the accuracy of connection.
2. Close the function block pin MANWREN (MANWREN=OFF). Make sure not to send the manual zero-adjust and amplitude-adjust.
3. Set the function block pin SPEEDTR to control the modification rate of auto zero-adjust and amplitude-adjust. If set as zero, it executes auto zero-adjust and amplitude-adjust in the modification rate of 5%/s of the default value.
4. The function block pin AUTOTUNE controls the start of auto zero-adjust and amplitude-adjust. When AUTOTUNE=ON, the auto zero-adjust and amplitude-adjust starts. PERCENT shows the process percent of module in auto zero-adjust and amplitude-adjust.
5. After the auto zero-adjust and amplitude-adjust finished, the function block pin PERCENT is set as 100. The module will decide if the amplitude value achieves 80%~98%, and if the zero value achieves 2%~20%. If they achieved, the function block pin ZEROBAD=OFF.

### 1.1.5 Manual Zero-adjust and Amplitude-adjust Function

Users can apply manual zero-adjust and amplitude-adjust for the control system when the LVDT auto zero-adjust and amplitude-adjust cannot be performed.

Fulfill the zero value in the function block pin MANZERO directly, and fulfill the amplitude value in MANFULL. The value of MANZERO should be less than the value of MANFULL. (The zero value and amplitude value will not be received if the former is larger than the latter.)

When the function block pin MANWREN is set as ON and parameters MANZERO and MANFULL work, the module will send the zero value and the amplitude value.

### 1.1.6 Self-dioagnosis Function

The module can perform self-diagnosis for hardware and function. The self-diagnosis function includes module type matching detect, terminal board power supply detect, AO output circuit detect, LVDT bias detect, LVDT disconnection detect, etc.

### 1.1.7 LVDT Disconnection Detect and Restore Functions

The electric fluid servo module obtains disconnection detect and restore functions. When the disconnection of one channel LVDT sensor occurs, the module will shield it and apply the real-time data of another one as the field feedback value and eliminate the large-deviations alarm. The LVDT fault will be displayed in the function block of operator station. After restore the disconnected

LVDT, click the ACKLVDT1 and ACKLVDT2, or the disconnection acknowledge buttons LVDT1 and LVDT2 of the operation panel, if the field is restored, the module can be work normally.

### **1.1.8 Start Logic Instruction**

The module takes manual mode as its initial mode. When powered on, it collects the larger selected value of LVDT as the manual output value.

The module sends manual status and output value after establishing communication. The operator station program sends the DEH valve position auto set value tracing manual output value to the module, after the controller decides that the unit is in manual mode. The module compares it to the manual output value, and when the difference between them is in the 4% of full range, the module switches to auto mode.



## Section 2 Specification

**Table 2-1 Specifications of AM722-S11**

Parameter		Description
Model		AM722-S11
Power Supply		24VDC (-10%~10%)
Temperature	Operating Temperature	-20℃~70℃
	Storage Temperature	-40℃~85℃
Humidity	Operating Humidity	10%RH~90%RH, No Vapor Condensation
	Storage Humidity	5%RH~95%RH, No Vapor Condensation
Redundancy		Not Support
Isolation Voltage	Channel to Field	500VAC, 50Hz, 60s
	Channel to channel	250VAC, 50Hz, 60s
Precision of Output Signal Driving the Electric Fluid Servo Valve	(-20~20)mA	0.2%
	(-10~10)V	
Precision of Output Signal Used for the Display on the Manual Operation Instrument	(0~20)mA	0.2%
Precision of Displacement Inspection		0.2%
Precision of Analog Input Signal		0.2%
DI Signal Features	ON	<1 k $\Omega$
	OFF	>100 k $\Omega$
Responding Time of DO Signal Output	ON->OFF	10ms
	OFF->ON	10ms
Maximum Output Current of DO		500mA
Load Capacity of Output Signal Used for Display on the Manual Operator Instrument		<750 $\Omega$

## Section 3 Usage Instruction

### 3.1 Signal Type

Table 3-1 Notes for Signal Types Connected with the Module

	Channel Number	Channel Type	Signal Type	Function	Direction
Part I: Control Output from Electric Fluid Servo Valve	2 Channels	Analog Output	(-20~20)mA, (-10~10)V	Electric Fluid Servo Valve Driving Signal. Signal Type can be Set by Jumper	Field
Part II: LVDT Feedback Signal Display	1 Channel	Analog Output	AO: (0~20)mA Corresponding Valve Position: (0~100)%	LVDT Signal Feedback Value (Larger Selected Value)	Manual Operator Instrument
Part III: digital signals	1 Channel	Digital Output	DO: Relay Output	Manual/Auto Feedback	Manual Operator Instrument
	1 Channel	Digital Output	DO: Relay Output	Hold	Hold
	1 Channel	Digital Input	DI: Dry Contact Input	Grid Connected Switch Tripping	Field
	1 Channel	Digital Input	DI: Dry Contact Input	Manual Operator Instrument Manual/Auto Switching Signal	Manual Operator Instrument
	1 Channel	Digital Input	DI: Dry Contact Input	Manual Operator Instrument Increasing Signal Manually	Manual Operator Instrument
	1 Channel	Digital Input	DI: Dry Contact Input	Manual Operator Instrument Decreasing Signal Manually	Manual Operator Instrument
Part IV: Analog input	2 Channels	Analog Input	Standard 4-Wire/ 6-Wire	LVDT Sensor Signal	Field
		Analog Input	(4~20) mA, No Power Supply	LVDT Feedback Signal Converted by Transducer	Field

### 3.2 LED Indicator Instruction

Table 3-2 LED Indicators for AM722-S11

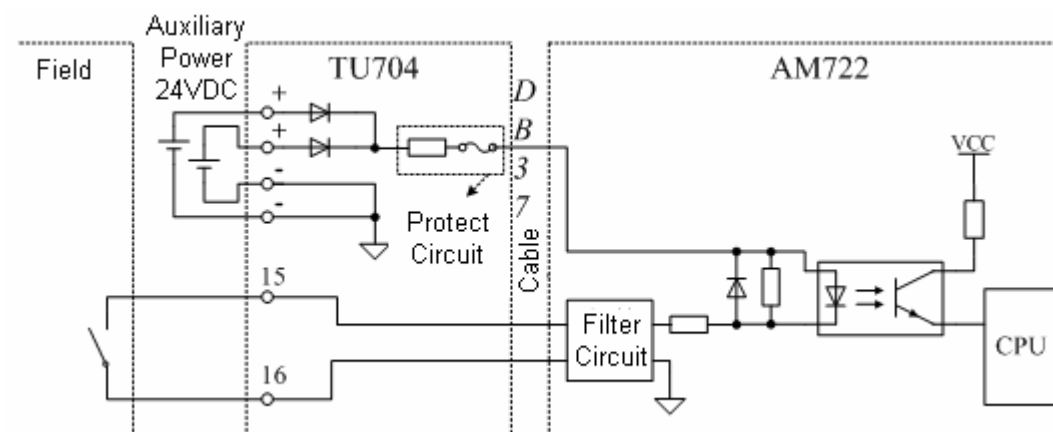
LED Indicator	Fault (Red)	Status (Green)	Duplex (Green)	L-Bus (Green)	Supply (Green)
Description	Fault Indicator	Running Indicator	Work/Standby	Communication Indicator	Power Supply of Channel Status Indicator
OFF	Normal	--	--	Communication Link Disconnected	Abnormal

LED Indicator	Fault (Red)	Status (Green)	Duplex (Green)	L-Bus (Green)	Supply (Green)
ON	Serious Fault	Normal	Work	Normal	Normal
Flash	--	No Configuration	--	Address Conflict	--

### 3.3 Interface Feature

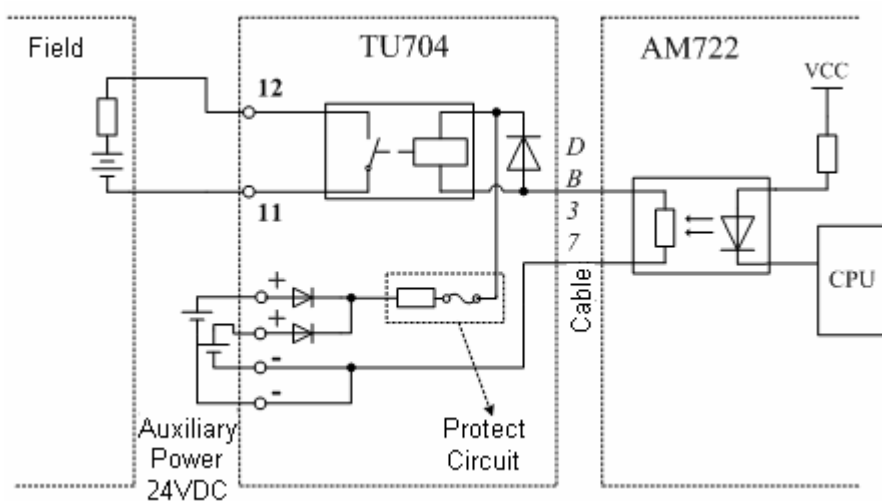
The interface feature diagrams of AM722-S11 are shown as below. They take the connection of 1 channel terminal as an example for instruction. Other details refer to the TU704-R1100 User Manual.

The dry contact input signal interface circuit is shown as below. It takes DI channel 1 as an example for the field connection instruction.



**Figure 3-1 Dry Contact Input Signal Interface Circuit**

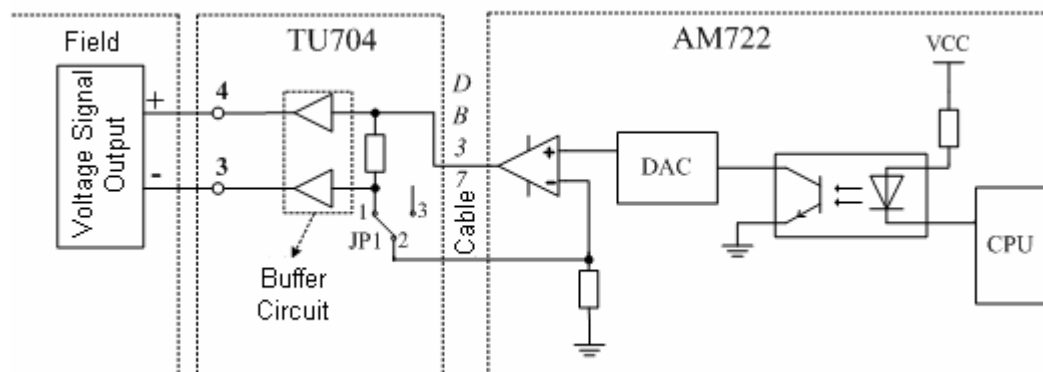
The dry contact output signal interface circuit is shown as below. It takes DO channel 1 as an example for the field connection instruction.



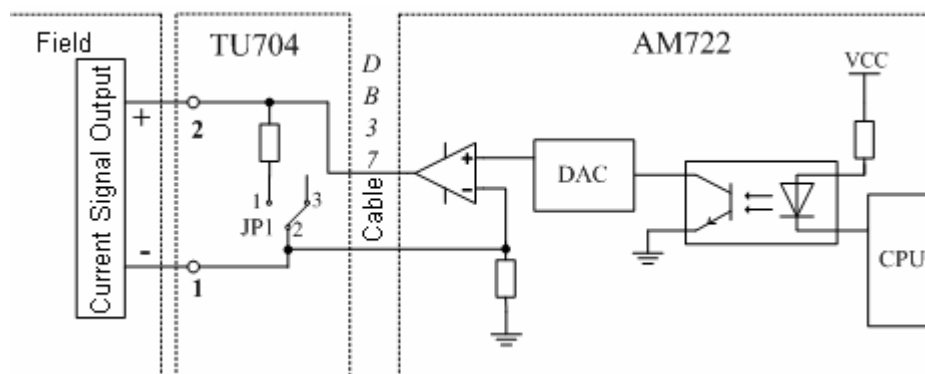
**Figure 3-2 Dry Contact Output Signal Interface Circuit**

The voltage signal and current signal output interface circuits are shown as below. They take

channel 1 as an example for field connection instruction. The current/voltage signal output selected jumper of channel 1 is JP1.

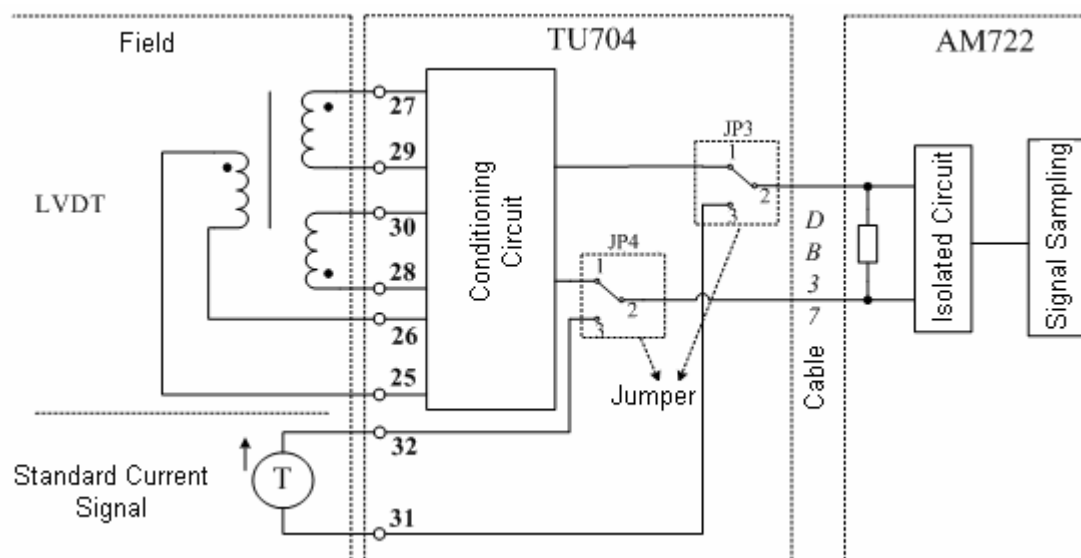


**Figure 3-3 Voltage Signal Output Interface Circuit**



**Figure 3-4 Current Signal Output Interface Circuit**

LVDT signal and standard current signal input circuit is shown as below. When the two jumpers JP3 and JP4 in the terminal board TU704-R1100 both jump to 1-2, it is the LVDT signal input circuit. When the two jumpers both jump to 2-3, it is the standard current signal input circuit. The terminal in the figure below takes LVDT1 as an example.



**Figure 3-5 LVDT Signal and Standard Current Signal Input Circuit**

### 3.4 Base/Terminal Board Selection

The AM722-S11 connects with the field by TU704-R1100. One TU704-R1100 works with one AM722-S11.

Please refer to the *TU704-R1100 User Manual* for the field connection of terminal board.

**Table 3-3 Base/Terminal Board Selection for AM722-S11**

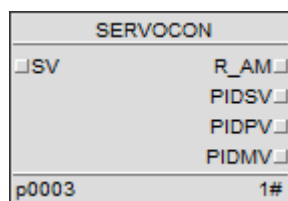
Signal Connection	Module Working Mode	Base Model	Terminal Board Model
Terminal Change-over	Single Module	MB745-S	TU704-R1100

### 3.5 Special Function Block Instruction

The electric fluid servo module should work with special function block.

#### 3.5.1 SERVOCON Function Block

The SERVOCON function block is shown as below, the hided pin can be changed in software.



**Figure 3-6 SERVOCON Function Block**

The pin parameter of SERVOCON module is shown as below.

**Table 3-4 Parameters of SERVOCON Module**

Parameter	Type	Initial Value	Description	Parameter Property	Remark
<b>Basic Parameter</b>					
<b>Hardware Settings</b>					
NODE	USINT	0	Node ID[0~7]	Configuration Parameter	
RACK	USINT	0	Rack ID[0~3]	Configuration Parameter	
IOM	USINT	0	Module ID[0~15]	Configuration Parameter	
<b>Extended Parameters</b>					
<b>Input Pin</b>					
SV	REAL	0	SV (%)	Input Pin	Default Pin
SWTV	BOOL	OFF	Output Track Switch (OFF=Not Track, ON=Track)	Input Pin	
TV	REAL	0	Output Track Value (%)	Input Pin	
<b>Output Pin</b>					

Parameter	Type	Initial Value	Description	Parameter Property	Remark
R_AM	BOOL	OFF	Module Manual-auto Switch (OFF=Auto, ON=Manual)	Output Pin	Default Pin
PIDSV	REAL	0	Loop SV (%)	Output Pin	Default Pin
PIDPV	REAL	0	Loop PV (%)	Output Pin	Default Pin
PIDMV	REAL	0	Loop Output Value (%)	Output Pin	Default Pin
<b>Auto Zero-adjust and Amplitude-adjust</b>					
AUTOTUNE	BOOL	OFF	The Enable of Auto Zero-adjust and Amplitude-adjust (OFF=Stop, ON=Start)	Operation Parameter	
OILTRPEN	BOOL	OFF	Enable Grid Connected Switch Trip Response (OFF=Disable, ON=Enable)	Operation Parameter	Parameter Uploading
PERCENT	USINT	0	The Percentage of Process of Auto Zero-adjust and Amplitude-adjust	Supervision Parameter	
ZEROBAD	BOOL	OFF	The Flag of Auto Zero-adjust and Amplitude-adjust (OFF=Success, ON=Failed)	Supervision Parameter	
SPEEDTR	REAL	5	The SV Change Rate of Zero-adjust and Amplitude-adjust (%/s)	Operation Parameter	Parameter Uploading
<b>Manual Zero-adjust and Amplitude-adjust</b>					
MANWREN	BOOL	OFF	Manual Modify LVDT Zero-adjust and Amplitude-adjust Enable (OFF=Disable, ON=Enable)	Operation Parameter	
MANZERO	REAL	0	LVDT Manual Zero-adjust Value (%)	Operation Parameter	Parameter Uploading
MANFULL	REAL	100	LVDT Manual Full-range Value (%)	Operation Parameter	Parameter Uploading
<b>Anti-jamming</b>					
SKEN	BOOL	OFF	Enable Anti-jamming (OFF=Disable, ON=Enable)	Operation Parameter	
FREQ	USINT	10	Frequency Value of Anti-jamming Vibration Signal (10Hz or 20Hz)	Operation Parameter	Parameter Uploading
RANGE	REAL	0.01	Amplitude of Anti-jamming Vibration Signal (%)	Operation Parameter	Parameter Uploading
<b>Acceleration Feedforward</b>					
ACCFBEN	BOOL	OFF	Acceleration Feedforward Control Enable (OFF=Not Feedforward, ON=Feedforward)	Operation Parameter	Parameter Uploading

Parameter	Type	Initial Value	Description	Parameter Property	Remark
ACCRATE	REAL	0	Accelerate Gain Coefficient	Operation Parameter	Parameter Uploading
R_ACC	REAL	0	Acceleration (r/min/s)	Supervision Parameter	
<b>PID Setting</b>					
PB	REAL	100	Proportion Param (0.01~655.35)	Operation Parameter	Parameter Uploading
TI	REAL	20	Integral Param (0.0s~6553.5s)	Operation Parameter	Parameter Uploading
TD	REAL	0	Derivative Param (0.0s~6553.5s)	Operation Parameter	Parameter Uploading
PIDPEI	BOOL	OFF	PID Positive Error Alarm	Supervision Parameter	
PIDNEI	BOOL	OFF	PID Negative Error Alarm	Supervision Parameter	
<b>Operator Command</b>					
ACKLVDT1	BOOL	OFF	LVDT1 Disconnect Recovery Confirm	Operation Parameter	
ACKLVDT2	BOOL	OFF	LVDT2 Disconnect Recovery Confirm	Operation Parameter	
<b>Output Limits</b>					
MH	REAL	100	Output H Limit (%)	Operation Parameter	Parameter Uploading
ML	REAL	0	Output L Limit (%)	Operation Parameter	Parameter Uploading
<b>Handheld Settings</b>					
STEPRATE	REAL	0.1	Handheld Step Value (%)	Operation Parameter	Parameter Uploading
<b>Debug</b>					
DEBUGAM	BOOL	OFF	Module Manual-auto Switch (OFF=Auto, ON=Manual)	Operation Parameter	
DEBUG	BOOL	OFF	Debug Switch (OFF=Not Debug, ON=Debug)	Operation Parameter	
MANMV	REAL	0	Valve Position Manual SV (% for Debug)	Operation Parameter	
<b>Alarm Limit</b>					
DLLVDT	REAL	5	Limit Value of LVDT Large-deviations Alarm (%)	Operation Parameter	Parameter Uploading
HYSLVDT	REAL	1	Hysteresis of LVDT Large-deviations Alarm (%)	Operation Parameter	Parameter Uploading
DLSVPV	REAL	5	SV Error Limit (%)	Operation Parameter	Parameter Uploading
TIMESVPV	REAL	120	SV Error Alarm Time Limit (s)	Operation Parameter	Parameter Uploading
<b>LVDT Monitor</b>					
LVDT1	REAL	0	LVDT1 Sampling Value (%)	Output Pin	
LVDT2	REAL	0	LVDT2 Sampling Value (%)	Output Pin	

Parameter	Type	Initial Value	Description	Parameter Property	Remark
LVDT1BAD	BOOL	OFF	LVDT1 Check (OFF=NORMAL, ON=DISCONNECT)	Output Pin	
LVDT2BAD	BOOL	OFF	LVDT2 Check (OFF=NORMAL, ON=DISCONNECT)	Output Pin	
SAMPMODE	USINT	0	LVDT Input Module: 0=2 Channels HSEL; 1=LVDT2 Single Select; 2=LVDT1 Single Select	Supervision Parameter	
R_LVDTZ	REAL	0	LVDT Zero-tag Readback Value(%)	Supervision Parameter	
R_LVDTF	REAL	0	LVDT Amplitude-tag Readback Value (%)	Supervision Parameter	
<b>Module Fault Monitor</b>					
LVDTMBAD	BOOL	OFF	LVDT Handheld Monitor Output Power Supply Fault (OFF=Normal, ON=Fault)	Supervision Parameter	
DDV1BAD	BOOL	OFF	Electric Fluid Servo Valve1 Power Supply Fault (OFF=Normal, ON=Fault)	Supervision Parameter	
DDV2BAD	BOOL	OFF	Electric Fluid Servo Valve2 Power Supply Fault (OFF=Normal, ON=Fault)	Supervision Parameter	
LVDTPBAD	BOOL	OFF	LVDT Module 15V Power Supply Fault (OFF=Normal, ON=Fault)	Supervision Parameter	
AUXPBAD	BOOL	OFF	Auxiliary Power Fault (OFF=Normal, ON=Fault)	Supervision Parameter	
EILVDT	BOOL	OFF	LVDT Large-deviations Alarm	Supervision Parameter	
FAIL	BOOL	OFF	Speed Detection Channel Fault (OFF=Normal, ON=Fault)	Supervision Parameter	
CFGERR	BOOL	OFF	Configuration Error Alarm	Supervision Parameter	
COMERR	BOOL	OFF	Communication Fault	Supervision Parameter	
ERR	BOOL	OFF	Function Block Alarm	Supervision Parameter	
SM1DISM	BOOL	OFF	Speed Detection Module 1 Match Signal (OFF=Match, ON=Dismatch)	Supervision Parameter	
SM2DISM	BOOL	OFF	Speed Detection Module 2 Match Signal (OFF=Match, ON=Dismatch)	Supervision Parameter	



Parameter	Type	Initial Value	Description	Parameter Property	Remark
SM3DISM	BOOL	OFF	Speed Detection Module 3 Match Signal (OFF=Match, ON=Dismatch)	Supervision Parameter	
<b>Module Status Monitor</b>					
BOOTING	BOOL	OFF	Module in Start Status (OFF=Started, ON=Starting)	Supervision Parameter	
HDWMAN	BOOL	OFF	Handheld Set Manual (OFF=Auto, ON=Manual)	Supervision Parameter	
PIDTR	BOOL	OFF	PID Track Status (OFF=Auto, ON=Track)	Supervision Parameter	
MV1	REAL	0	MV1 (%)	Supervision Parameter	
MV2	REAL	0	MV2 (%)	Supervision Parameter	
<b>Alarm Enable and Suppress</b>					
AOF	BOOL	OFF	Suppress Module Alarm	Operation Parameter	Parameter Uploading
ENALM	UDINT	0x0	Alarm Enable	Alarm Parameter	Parameter Uploading
FLAG	UDINT	0x0	Flag	Output Pin	

### 3.5.2 Notices for special module

- MANZERO, MANFULL and MANWREN

MANZERO is the parameters of the zero value written in the manual zero-adjust and amplitude-adjust mode. MANZERO is less than MANFULL, otherwise the writing is invalid

MANFULL is the parameters of the amplitude value written in the manual zero-adjust and amplitude-adjust mode.

MANWREN is the writing switch, and when it is allowed to write when set as ON, or it is forbidden to write. MANWREN should be set as OFF when preparing for auto zero-adjust and amplitude-adjust.

As the MANWREN is the fault restoring switch of module LVDT, the zero amplitude readback value should be tracked to the manual zero amplitude value when applying the 2-channel LVDT sensor mode.

- FREQ, RANGE and SKEN

FREQ is the frequency value of anti-jamming signal, which can only be set as 10 or 20, representing two types of anti-jamming signals in two different frequencies.

RANGE is the amplitude value of anti-jamming signal, which is valid when the range of setup value is 0~1.000.

SKEN means whether to start up the anti-jamming signal. Starting does not mean that the actual anti-jamming signal works.



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**Attention:**

Generally, starting the anti-jamming signal is prohibited when the module works normally. It can be started only when jamming occurs on the turbine adjust valve, and the anti-jamming signal should be closed immediately once the adjust valve is restored to normal. If anti-jamming signal should be kept in operation when controlling special control components like SVA9 valve, please apply carefully according to the control object.

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- STEPRATE

STEPRATE means the step value of manual increase/ decrease signal in the manual operation instrument, which can only set up the value between 0~2, corresponding to 0~2% of the valve jaw opening.

For example, if it is as 1, then press the manual increase button on manual operation instrument once and the offer value for corresponding valve position increases 1%.

- SPEEDTR and AUTOTUNE

SPEEDTR means the change speed of the auto zero-adjust and amplitude-adjust, which can set up the value between 0~10, representing the actual change speed is between 0%/s and 10%/s. When it is set as 0, it adopts the default value of 3%/s. It is required to follow the default value to have the automatic adaptation, and except special circumstance, it is strictly forbidden to randomly set this parameter.

AUTOTUNE is the starting position of auto zero-adjust and amplitude-adjust. After started, it is strictly forbidden to operate the pin MANWREN on the function module during the process of zero-adjust and amplitude-adjust.

- PB, TI and TD

PB means the proportion coefficient in the PID calculation, with the range of 0.01~655.35 which means 1%~65535%.

TI means the integral parameter in the PID calculation, with the range of 0~6553.5, representing the integral time of 0~6553.5s.

TD means the differential parameter in the PID calculation, with the range of 0~6553.5, representing the integral time of 0~6553.5s.

- SV

SV means the set value of valve value sent by system operator station. The range of 0~100 corresponds to the jaw opening of adjust valve of 0%~100%.

- TV and SWTV

TV means the output tracking value, and the range of 0~100 corresponds to the jaw opening of adjust valve of 0%~100%.

When SWTV is set as ON, MV will directly track the value of TV. Tracking status means the PID calculation fails, and except special requirements, SWTV should be set as OFF.

- ML and MH

ML and MH are used to limit the upper and lower limits of MV, and except special requirements, ML should be set as 0, and MH should be set as 100.

- R\_LVDTZ and R\_LVDTF

R\_LVDTZ and R\_LVDTF represent the zero and amplitude used in the calculation at present, and the range of 0~100 corresponds to the jaw opening of the adjust valve of 0%~100%.

- BOOTING

When BOOTING is ON, it represents that the module is in the status of start logic, and does not enter the primary circle.

- EILVDT

EILVDT means two channels LVDT signal large-deviations alarm. The sampling value large-deviations alarm limit of two channels LVDT1 and LVDT2 can be set by DLLVDT.

- LVDT1BAD and LVDT2BAD

LVDT1BAD and LVDT2BAD mean two channels LVDT disconnect alarm. When channel 1 disconnects, LVDT1BAD is ON for alarm. When channel 2 disconnects, LVDT2BAD is ON for alarm.

- SM1DISM, SM2DISM and SM3DISM

SM1DISM, SM2DISM and SM3DISM means the mismatch alarm of speed measurement modules 1, 2 and 3.



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**Tip:**

Details of function blocks refer to their user manuals or online help. If there is inconsistency, please apply the function block user manual.

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## 3.6 Installation & Wiring of LVDT Sensor

### 3.6.1 INSTALLATION

1. Firstly fix the base of LVDT and according to the movement direction of connecting rod when the field valve opens and closes, install the LVDT base in parallel.
2. Connect the signal wire of LVDT (Refer to the notes for wiring of LVDT), and after turning on, check whether operation station can correctly acquire the LVDT signal or not. Pull the sliding

rod, and observe whether the display value can change or not.

3. After correctly acquiring the signal, use the multimeter to measure the AC voltage on the both sides of the secondary coil on the field (For judgment method of secondary coil, refer to notes for wiring of LVDT). Pull the sliding rod of LVDT, and when AC voltage is 0V, mark the position at this time is the central position.
4. After marking the central position, according to the specific opening degree of the valve, from the central position to the both sides, take the distance of half of the opening of the actual journey of the oil driver to be marked, as the scale of full journey of LVDT and the scale of zero journey of LVDT.
5. Fully close the valve, and consider the movement direction of the valve to fix the sliding rod, to basically level the scale of zero journey of LVDT with the edge of the fixed cylinder.
6. Installation of two LVDT is totally the same, and after installation, open the valve slowly from zero to full, observe whether the alarm for great windage between two channels of LVDT on the upper position machine occurs or not, and if so, it needs to readjust the installation. At the same time, it needs to ensure the zero value within 4%~20%, and the full range within 80%~96%, and if not, it needs to refer the manual to adjust the code-dialing switch on TU704-R1100 module.

### 3.6.2 Wiring

1. Judge the primary and secondary coils of LVDT:

All LVDTs are in the six-wire system, i.e. LVDT directly leads out six wires (Usually the colors are yellow, brown, black, green, blue and red), which are divided into three groups, with one group of primary coil and two groups of secondary coils. Use the multimeter to measure the resistance between every two wires in six wires, and the resistance in the same group of coils is relatively small, which usually is about hundreds of  $\Omega$ , and the resistance between two wires in different groups is about hundreds of  $k\Omega$ , and the resistance between primary coils is smaller than that between secondary coils.

For example: Take the LVDT in model 4000TD as an example, we can measure the resistance between the two wires in yellow and brown is about  $170\Omega$ , that between two wires in black and green is about  $250\Omega$ , that between two wires in blue and red is about  $250\Omega$ , and the resistances between other every two wires all are about hundreds of  $k\Omega$ . So that we can judge the two wires in yellow and brown are the primary coil, and wires in black and green are one group of secondary coil, and wires in blue and red are another group of secondary coil.

2. Secondary coil connection with terminals 27 and 28 (LVDT1) or 35 and 36 (LVDT2).

Connection of LVDT needs to connect the homonymous terminal of two groups secondary coils with terminals 27 and 28 (LVDT1) or 35 and 36 (LVDT2), and the rest two homonymous terminals and the primary coils for four wires in total will be connected to the wiring terminal corresponding to TU704-R1100.

Due to the homonymous terminal of the secondary coil cannot be directly measured, from the beginning, randomly select one wire from two secondary coils to respectively connect with terminals 27 and 28 (LVDT1) or 35 and 36 (LVDT2), and then connect the rest four wires in total of

two wires on the secondary coil and the primary coil to the TU704-R1100 terminal board (Primary connects with primary correspondingly, secondary connects with secondary correspondingly and not consider the polarity of the coil temporarily). At the same time, connect TU704-R1100 with the module AM722-S11, and power on, and manually pull the LVDT pole, and use the multimeter to measure the AC voltage between two wires on the secondary coil on TU704-R1100 terminal board.

If the AC voltage measured changes with the LVDT pole pulled correspondingly: Pull to the middle position, and the AC voltage is the minimum, and when the positions pulled are the minimum and the maximum, the AC voltage is the maximum. This means the connection of the secondary coil on the field is correct. Contrarily, if the AC voltage on the secondary coil almost has no change as the movement of LVDT pole, it means the connection of secondary coil is wrong, and it only needs to connect the other wire in one group of the secondary coil with the original wire in the other secondary coil.

For example: still take the foresaid example, after measuring the resistance, we have known the two wires in yellow and brown are the primary coil, and wires in black and green are one group of secondary coil, and wires in blue and yellow are another group of secondary coil. Randomly connect the wires in black and red with terminals 27 and 28 (LVDT1) or 35 and 36 (LVDT2), and then connect the wires in yellow, brown, green and blue with the TU704-R1100 terminal board, measure the two sides of wires in black and blue again, find out the pole is moved to the middle position, and the AC voltage on black and blue wires is about 0V, and when the pulling pole is moved to the maximum or the minimum, the AC voltage is about 1.7V, which means the connection is correct.

### 3. Relation between positive and negative poles in the primary & secondary coils

In the notes for wiring of TU704-R1100 terminal board, we can see the characters of primary coil (+), primary coil (-), secondary coil (+) and secondary coil (-), and in fact, for the coil, all the signals it transmits are the AC signals, so there is no difference between positive and negative poles, but after the wiring, it must generate the signal output that meets the characteristics of valve position, i.e. when the distance of the pulling pole pulled out is the shortest, AM722-S11 module will export the maximum signal, and when the distance is the longest, AM722-S11 module exports the minimum signal. If the actual output is opposite, exchange the two wires on the primary coil (or the secondary coil) to be connected.

For example: Still follow the foresaid example, connect the wires in yellow, brown, black and blue to the primary coil (+), primary coil (-), secondary coil (+) and secondary coil (-) on the TU704-R1100 terminal board, turn on the power, pull the LVDT pole, and measure the DC voltage of TERMINALS L1+/L1- or L2+/L2- of TU704-R1100, and find out when the distance of the pole pulled out is the shortest, the output of AM722-S11 module is about -5V, and when the distance is the longest, the output of AM722-S11 module is about 5V, which is inconsistent with the characteristics of the valve position. Therefore exchange the positions of wires in yellow and brown (or black and blue), and connect wires in brown, yellow, black and blue (or yellow, brown, blue and black) to the primary coil (+), primary coil (-), secondary coil (+) and secondary coil (-) on the TU704-R1100 terminal board correspondingly.

## Section 4 Application

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### 4.1 Fault Diagnosis and Troubleshooting

1. If the Fault indicator is generally ON, the module has serious fault and should be replaced.
2. If the L-Bus indicator is OFF, users should check the communication connection, and if it is normal, the module has fault and should be replaced.
3. If the L-Bus indicator is flash, it has address confliction. Users should check the conflicted modules in the bus.
4. If the Supply indicator is OFF, please install module again. If the Supply indicator is also OFF, the module has fault and should be replaced.
5. If all indicators of the module are OFF after powered on, user should check the power connection. If it is normal, the module has fault and should be replaced.

## Section 5 Revision

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*Table 5-1 Retrofit list of the version*

Document Version	Applicable Module Version	Remarks
V1.0(20141220)	AM722-S11 V12.13.00 and later versions	
V1.1(20151102)	AM722-S11 V12.13.00 and later versions	Modify the attention in page 14
V1.2(20161116)	AM722-S11 V12.13.00 and later versions	Add code
V1.3(20170922)	AM722-S11 V12.13.00 and later versions	Modify some information
V1.4(20210608)	AM722-S11 V12.13.00 and later versions	Modify Parameter in PID setting