

Model AM012

Magnetic Flowmeter Calibrator

IM 1E6K2-E

IM 1E6K2-E
6th Edition

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1. INTRODUCTION

The Model AM012 Magnetic Flowmeter Calibrator was accurately adjusted prior to shipment.

This manual covers the specifications, installation, and operation of the AM012.

The specifications and relevant components covered by this manual are limited to those of the standard model under the specified model number. In addition, some of the standard specifications are subject to change without notice for enhancement purposes.

Should the instrument fail, please provide a component description and history of the failure together with the instrument model and serial numbers. The inclusion of any relevant data and simplified drawings will be greatly appreciated.

If any unauthorized repairs are attempted without specific authorization from YOKOGAWA Electric Corporation, the user assumes full responsibility for the instrument's performance.

If any problems or questions should arise, please contact your nearest YOKOGAWA agent.

2. HANDLING PRECAUTIONS AND REQUISITES

The Model AM012 Magnetic Flowmeter Calibrator is thoroughly tested at the factory before shipment. However, when the instrument is delivered, make a visual check to ascertain that no damage occurred during shipment.

This section describes important precautions and requisites to be observed when handling the instrument. Carefully read this manual before using the instrument.

If there are any problems or questions, please contact the nearest YOKOGAWA service center or the dealer from whom the instrument was purchased.

2.1 Model Name and Specifications

The Model name and main data are indicated on the name plate attached at the rear of the case (see Figure 2.1).

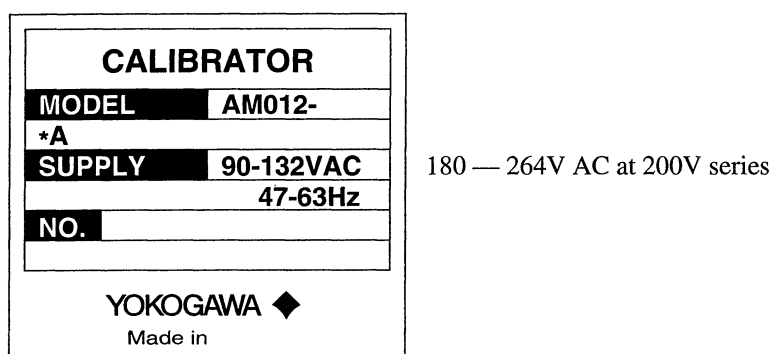


Figure 2.1 Data Plate

Verify that the data are the same as those specified at the time when it was ordered, referring to the Model and Suffix Codes in Section 3.2.

When contacting us, please indicate the Model and the instrument serial number.

2.2 Handling and Storing Precautions and Requisites

Precautions and requisites to be taken when handling and storing this instrument:

- (1) Prevent excessive shock to the instrument.
- (2) Protect the instrument from water and precipitation.
- (3) Calibrate the instrument at normal temperature and humidity.
- (4) Avoid installation or storage of the instrument in a corrosive atmosphere.
- (5) Store the instrument in a location:
 - free from water and precipitation.
 - relatively free from vibration and shock.
 - where the ambient temperature is between 0°C and 40°C and the humidity is between 5% and 80% relative humidity (well-ventilated and without condensation).

3. GENERAL

The AM012 Calibrator is a standard signal generator used to check or calibrate the AM11 Magnetic Flow Converter, ADMAG AE Magnetic Flowmeter, ADMAG CA Magnetic Flowmeter, AM12 Magnetic Flow Converter, AM100A/B or AM200A/B Magnetic Flowmeter, YMA11 Magnetic Flow Converter and Compact YEWMAG Magnetic Flowmeter (CYM for short), styles A and B. (Style A or style B is indicated on the name plate: style A as *A and B as *B.)

The excitation load is incorporated in the calibrator, so the converter can be checked or calibrated without using a flow detector.

Span can be set from 0 to 10.99 m/s. The output signal related to the span can be set to 0, 25, 50, 75 and 100% using the output (%) knob.

3.1 Standard Specifications

● AM012

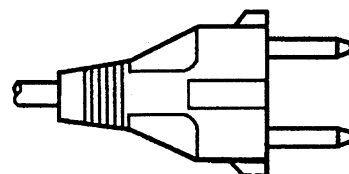
Case	: Material : Unsaturated polyester resin Dimensions : 110mm (H)×235mm (W)×364mm (D) Color : Light grayish green
Wiring cable	: Special cables supplied are: AM012 power cord, signal and excitation cables CYM signal cable and excitation cable (optional)
Range setting	: 0 to 10.99 m/s (minimum scale 0.01 m/s) with the span-setting dial. CHECK, 0, 25, 50, 75, 100% with output (%) knob.
Accuracy	: ±0.04% of set value (span 0.1 m/s or greater) +0.04 mm/s (span less than 0.1 m/s)
Power supply requirements	: 90 to 132 V AC or 180 to 264 V AC, 47 to 63 Hz
Ambient temperature limits	: 0 to 40°C
Weight	: 4.2kg
Power cord plug	: Three types of plugs are available (select any one of the following three): (-1) For 100 V AC (for domestic use) (-2) For 100 V AC (UL Standard) (-3) For 200 V AC (CEE Standard)



(-1) 100 V series
(for domestic use)



(-2) 100 V series
(conforms to UL standard)



(-3) 200 V series
(conforms to CEE standard)

Figure 3.1 Power Cord Plugs

● **Junction box for ADMAG AE and ADMAG CA**

Case : Material : Stainless steel
 Dimensions : 140.5mm(H)×112.4mm(W)×112.4mm(D)
 Color : Light gray
 Power supply requirements : 80 to 264V AC / 80 to 130V DC or 24V DC
 Ambient temperature limits : 0 to 40°C
 Weight : 1kg

● **Junction box for ADMAG SE**

Case : Material : Stainless steel
 Dimensions : 140.5mm(H)×112.4mm(W)×112.4mm(D)
 Color : Light gray
 Power supply requirements : 100V AC, 230V AC or 24V DC
 Ambient temperature limits : 0 to 40°C
 Weight : 1kg

3.2 Model and Suffix Codes

Model	Suffix Code	Description
AM012	Magnetic flowmeter calibrator
Power code	-1.....	100 V series (for domestic use)
	-2.....	100 V series (UL standard)
	-3.....	200 V series (CEE standard)
Style code	*A.....	Style A
Options	/CYM	CYM cable
	/AE	Junction box for ADMAG AE and ADMAG CA
	/SE	Junction box for ADMAG SE

3.3 Options

CYM cables : Signal and excitation cables for CYMs (option code CYM) are available optionally to calibrate the Compact YEW MAG.

Junction box for ADMAG AE and ADMAG CA:

Junction box are available optionally to calibrate the ADMAG AE and ADMAG CA.

Junction box for ADMAG SE:

Junction box are available optionally to calibrate the ADMAG SE.

3.4 Accessories

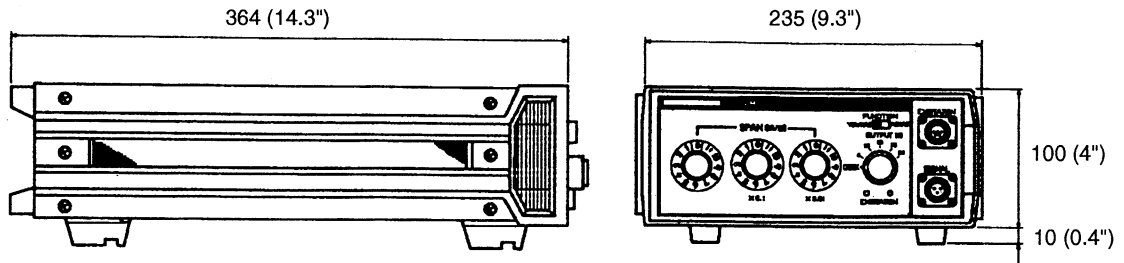
- One power supply cord (types of plugs vary depending on MS code.)
- One fuse (1 A)
- One signal cable
- One excitation cable
- Cable for CYM (When /CYM is selected)
- Junction box (When /AE or /SE is selected)
- Special cable for ADMAG SE (When /SE is selected)

The cables are stored in a cord container on the rear panel. To open the container cover, pull the container cover knob forward.

3.5 External Dimensions

All dimensions in millimeters:

● AM012



● Junction box for ADMAG AE

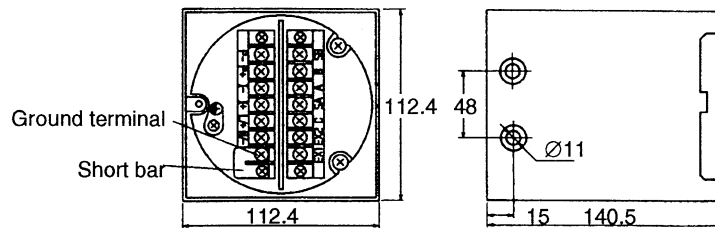


Figure 3.5 External Dimensions

3.6 Component Identification

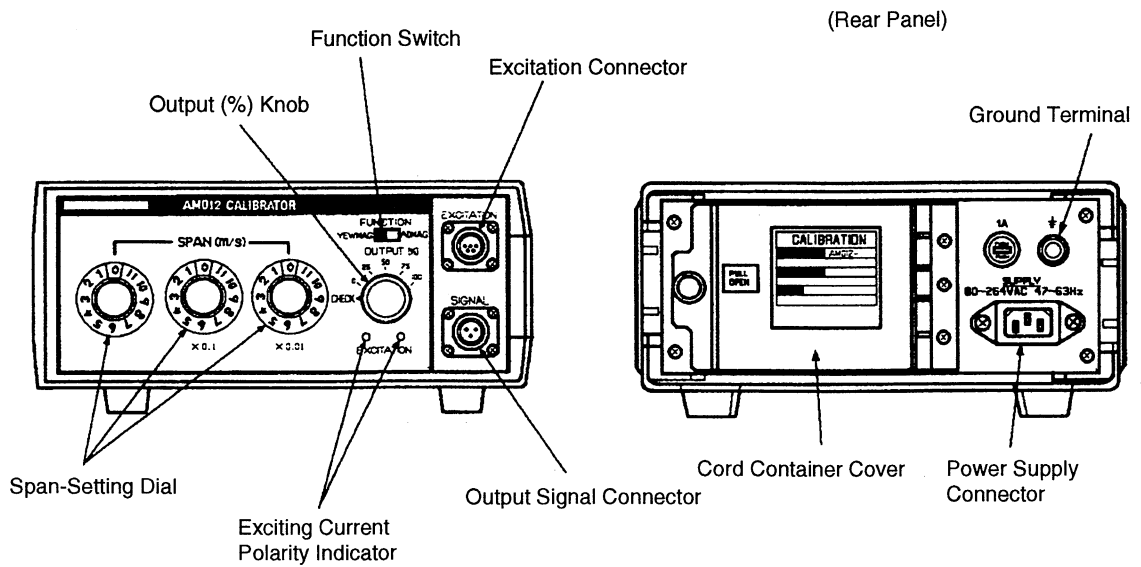


Figure 3.6 Component Identification

4. OPERATION

This chapter describes calibration procedures when the AM012 calibrator is used with: AM11(in Section 4.1), ADMAG AE, ADMAG CA(in Section 4.2), ADMAG SE(in Section 4.3), AM12, AM100A/B, AM200A/B(in Section 4.4), YMA11(in Section 4.5), Compact YEWMAG (CYM)(in Section 4.6)

Refer to each section to perform the desired calibration.

4.1 When AM012 is used with AM11

4.1.1 Interconnections

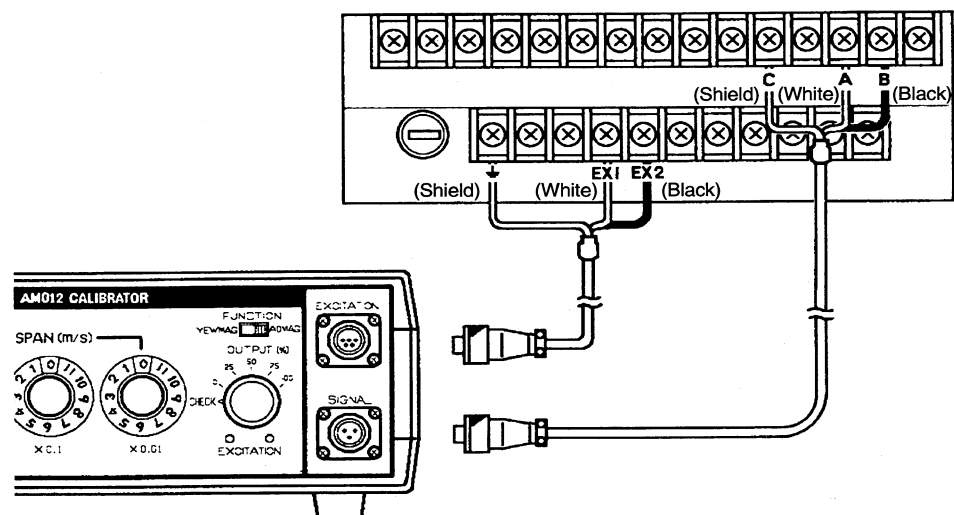
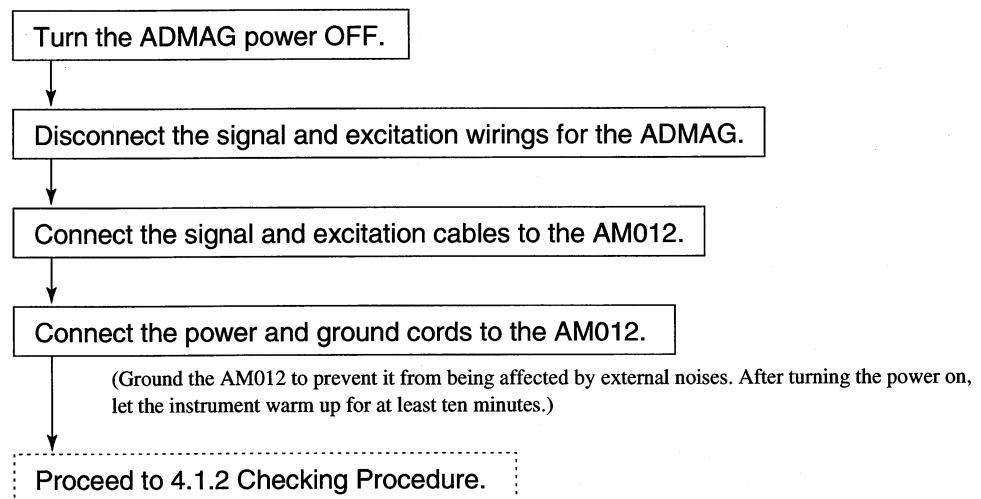
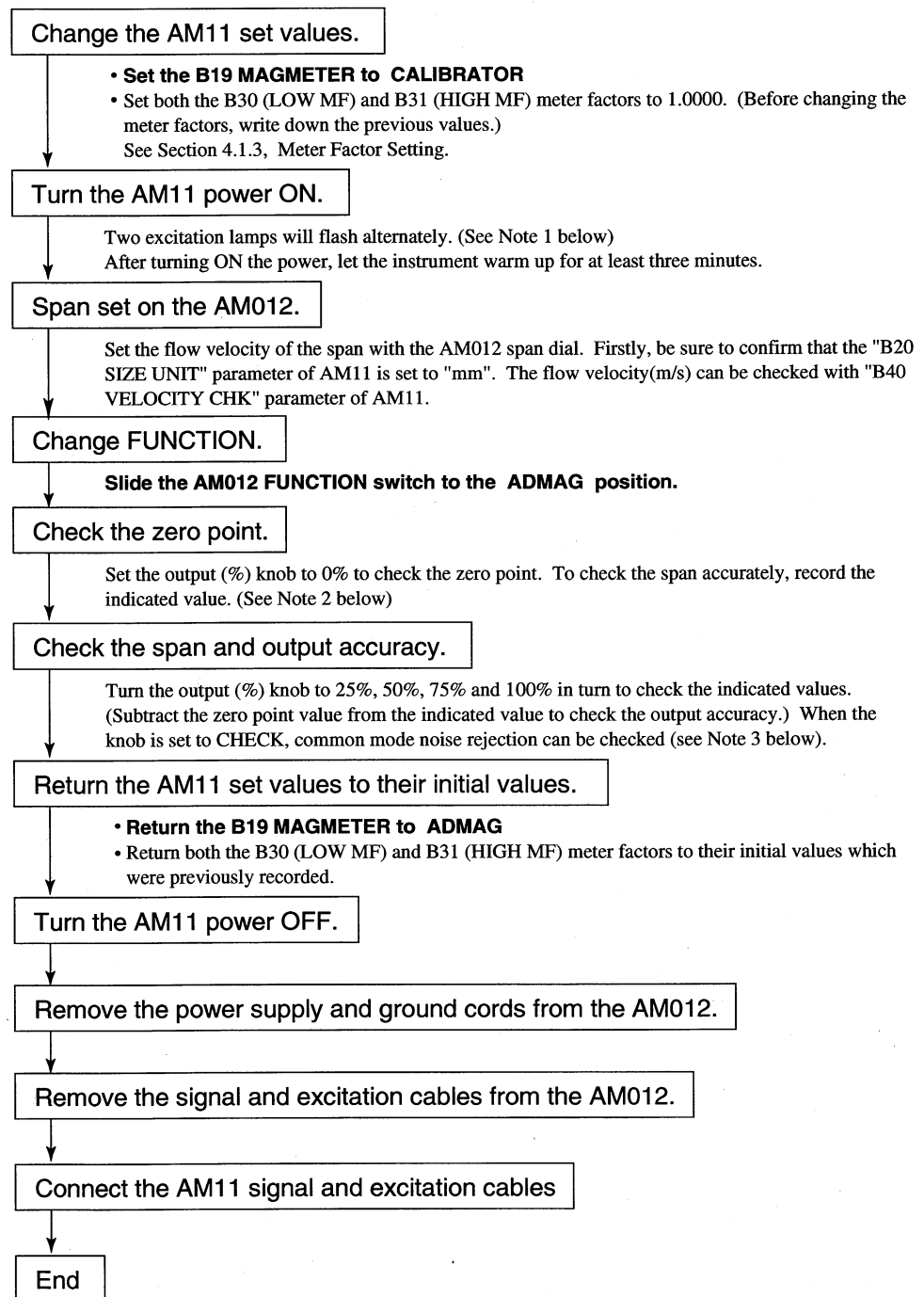


Figure 4.1.1 Interconnection Diagram

4.1.2 Checking Procedures



Note 1 : If no exciting current flows, the two excitation lamps do not flash correctly.

Note 2 : When the flowmeter is completely filled with liquid that is at a standstill, make an automatic ADMAG zero adjustment. If stopping the liquid flow is not possible, do not make an automatic ADMAG zero adjustment.

Note 3 : A common mode noise signal equivalent to a set value with the span-setting dial is output from the AM012.

4.1.3 Meter Factor Setting

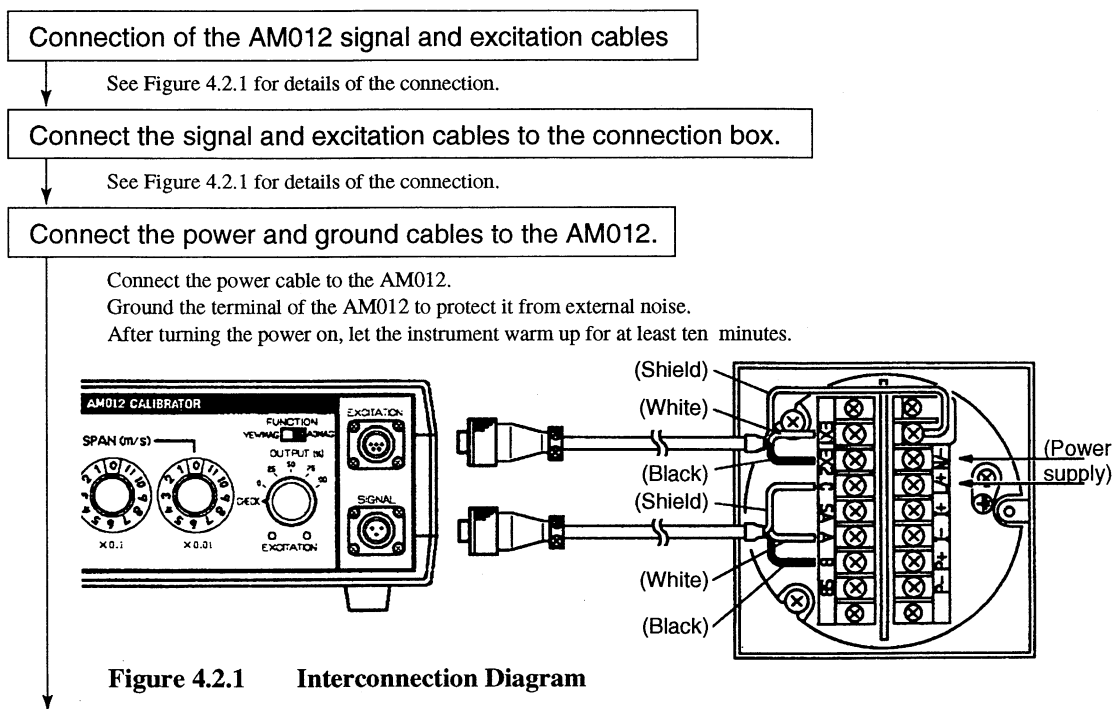
The meter factors can be set using four AM11 converter keys. Data can be set with the M10 TUNING in the ENABLE position. Set the display menu to B30 LOW MF with the [SHIFT] and [INC] or [DEC] key. Then set the meter factor to 1.0000 with the [SHIFT] and [INC] or [DEC] and [SET] keys.

ADMAG requires two meter factors. So, set the meter factor to 1.0000 for B31 HIGH MF, too. For details, refer to the AM11 Instruction Manual IM 1E6C1-01E, or IM 1E6C1-02E.

4.2 When AM012 is used with ADMAG AE and ADMAG CA

When using the AM012 calibrator with the ADMAG AE or ADMAG CA, remove the amplifier only from the converter and put it in the dedicated junction box for calibration. If /AE is selected for the optional specifications, this junction box is provided. The junction box can also be obtained separately.

4.2.1 Interconnections



Remove the amplifier unit from the converter.

- How to remove the amplifier unit
 - (1) Turn the ADMAG AE or ADMAG CA power off.
 - (2) Remove the cover of the converter.
 - (3) Loosen the four screws (M4) which secure the amplifier as shown in Figure 4.2.2.
 - (4) Draw out the amplifier forwards a little, and disengage the connectors as shown in Figure 4.2.3
 - (5) Place the removed amplifier on an insulating pad.

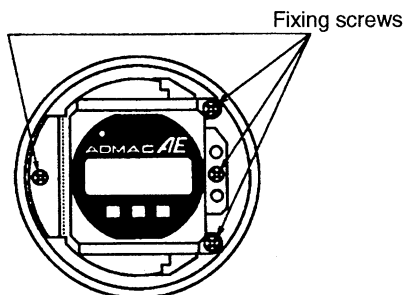


Figure 4.2.2 Positions of Fixing Screws

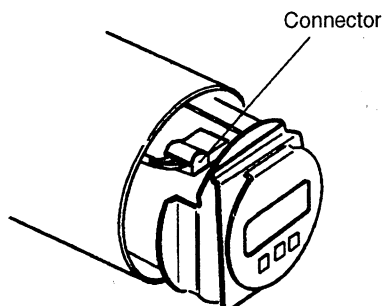


Figure 4.2.3 Connector Position

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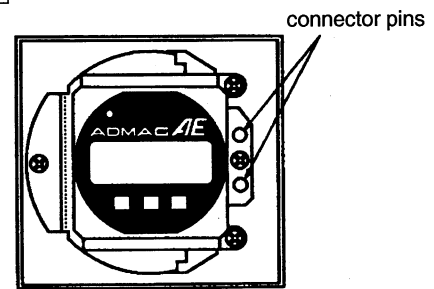
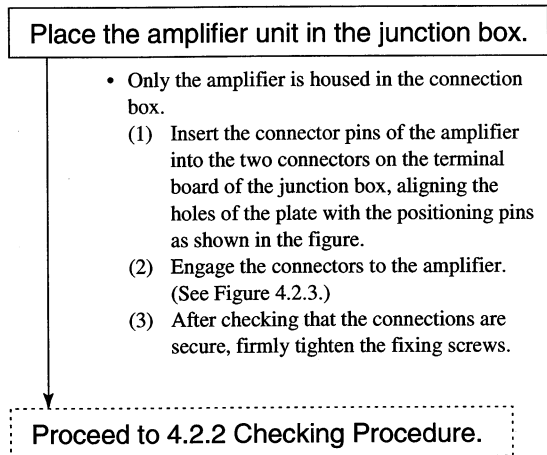
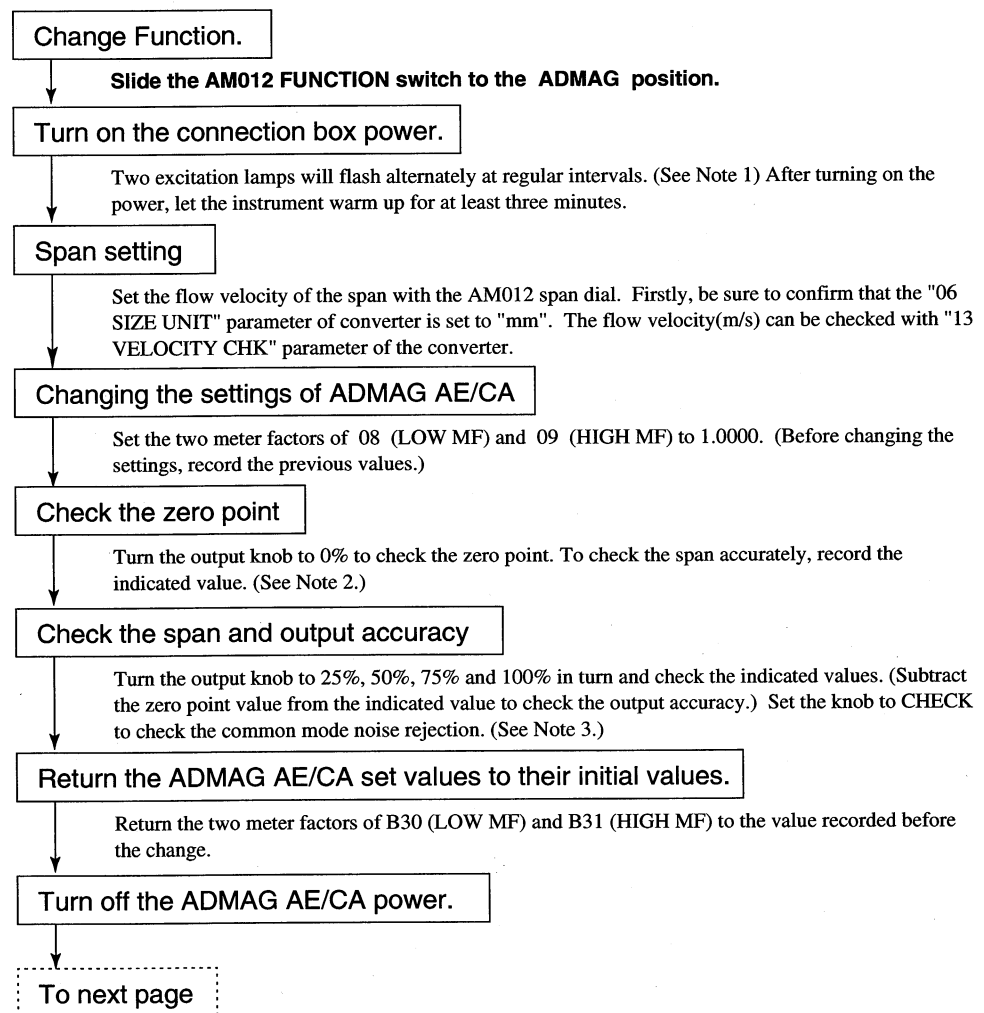
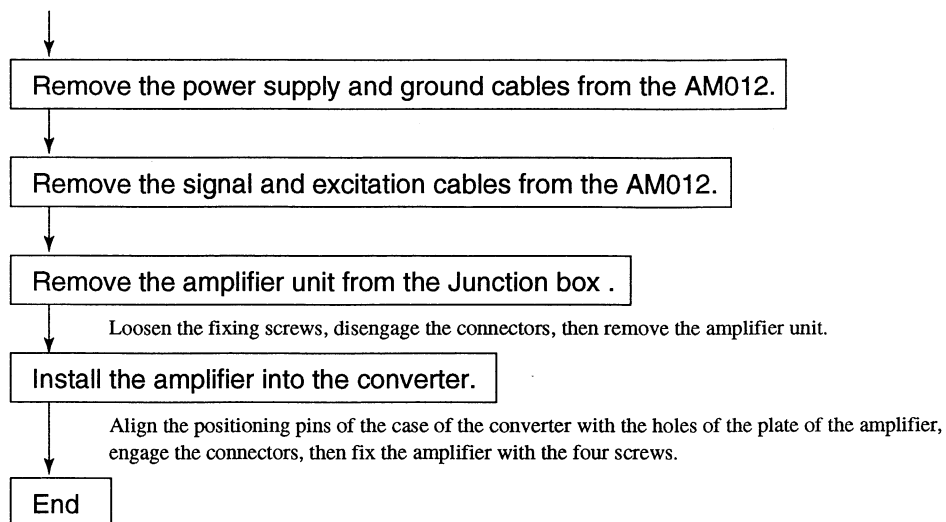


Figure 4.2.4 Connector Position

4.2.2 Checking Procedure





Note 1 : If no exciting current flows, the two excitation lamps do not flash correctly.

Note 2 : When the flowmeter is completely filled with liquid that is at a standstill, make an automatic ADMAG zero adjustment. If stopping the liquid flow is not possible, do not make an automatic ADMAG zero adjustment.

Note 3 : A common mode noise signal equivalent to a set value with the span-setting dial is output from the AM012.

4.3 When AM012 is used with ADMAG SE

When calibrating SE, remove the amplifier only from the magnetic flowmeter and wiring by special cable, then put it in the dedicated junction box for calibration. If SE is selected for the optional specifications, this junction box and special cable is provided. The junction box can also be obtained separately.

4.3.1 Interconnections

Remove the amplifier unit from the flowmeter

- (1) Turn the ADMAG SE power off.
- (2) Remove the cover of the converter.
- (3) Loosen the three screws which secure the amplifier as shown in Figure 4.3.1.
- (4) Draw out the amplifier forwards a little, and disengage the connectors for signal line and excitation cable as shown in Figure 4.3.2.
- (5) Place the removed amplifier on an insulating pad.

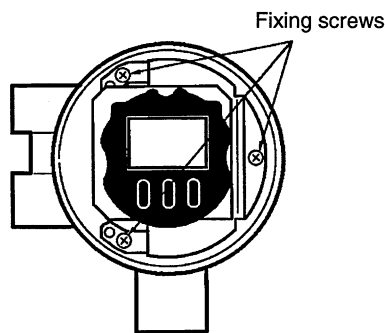


Figure 4.3.1 Positioning of Fixing Screws

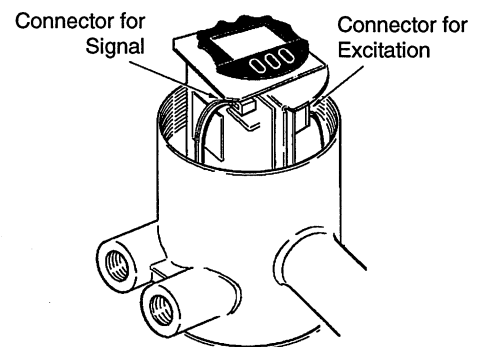


Figure 4.3.2 Connector Position

Wiring by special cable to the amplifier

Connect attached special cable (excitation cable and signal cable) to the amplifier. See Figure 4.3.3 for details of the connection.

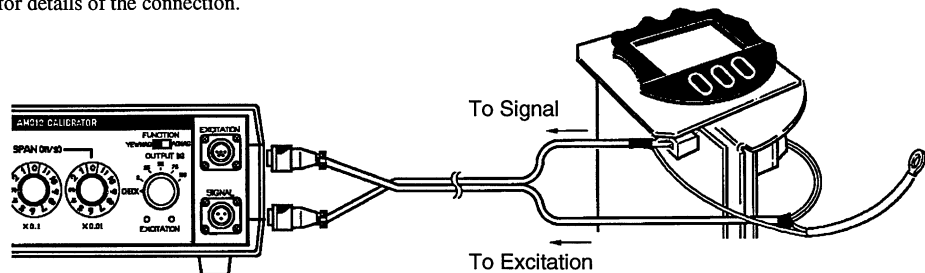


Figure 4.3.3 Interconnection Diagram

Connection of the special cable to the AM012

Connect the special cable to the AM012. See Figure 4.3.3 for details of the connection.

To next page

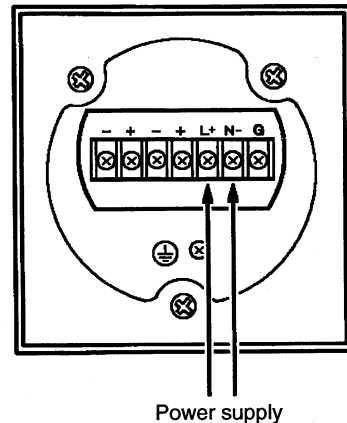
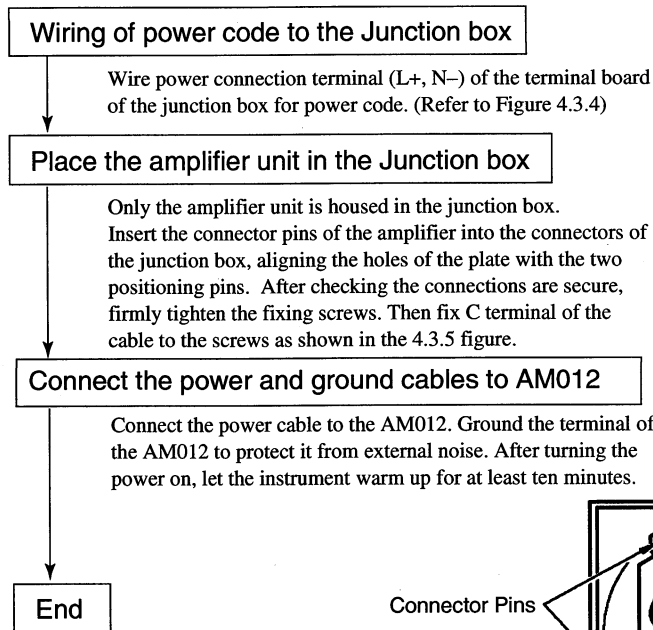


Figure 4.3.4 Connector position

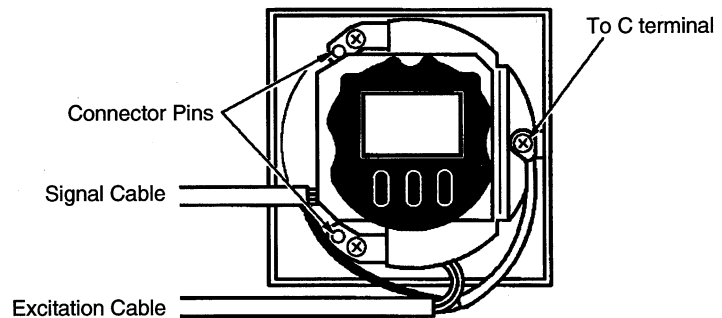
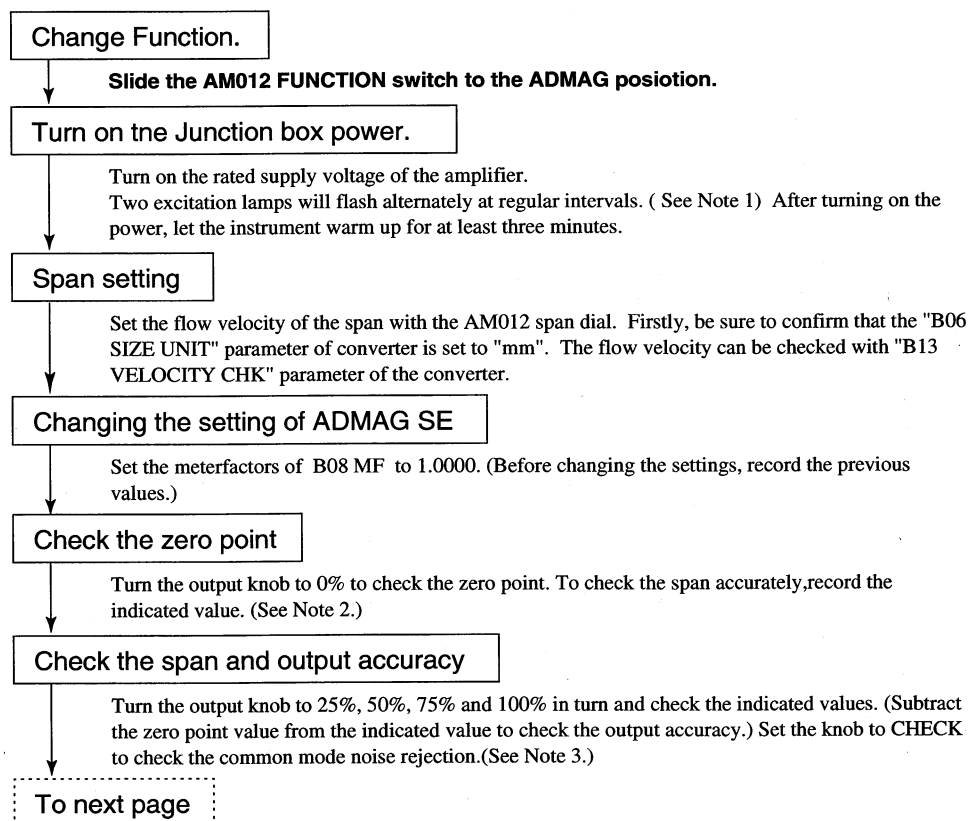
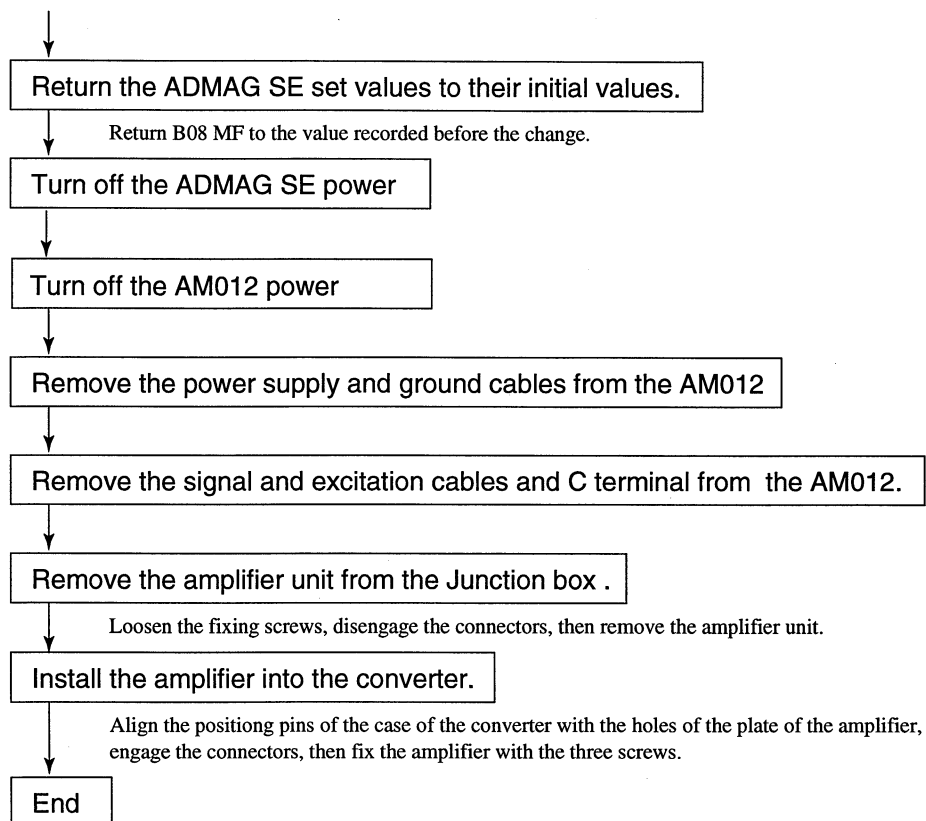


Figure 4.3.5 Connector position

4.3.2 Checking procedure





Note 1 : If no exciting current flows, the two excitation lamps do not flash correctly.

Note 2 : When the flowmeter is completely filled with liquid that is at a standstill, make an automatic zero adjustment. If stopping the liquid flow is not possible, do not make an automatic zero adjustment.

Note 3 : A common mode noise signal equivalent to a set value with the span-setting dial is output from the AM012.

4.4 When AM012 is used with AM12 and AM100/200

4.4.1 Interconnections

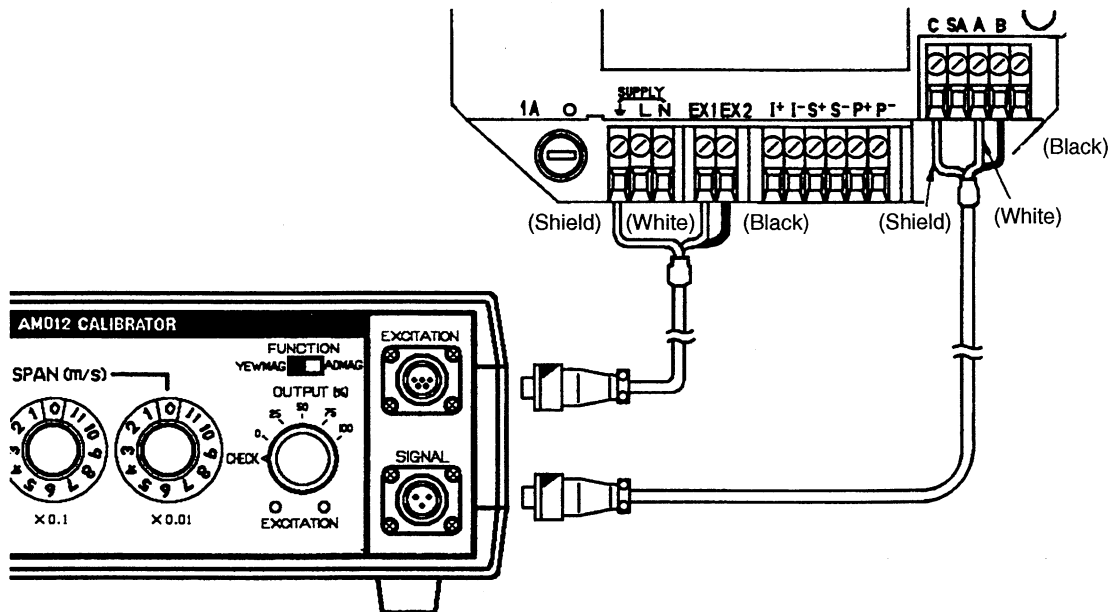
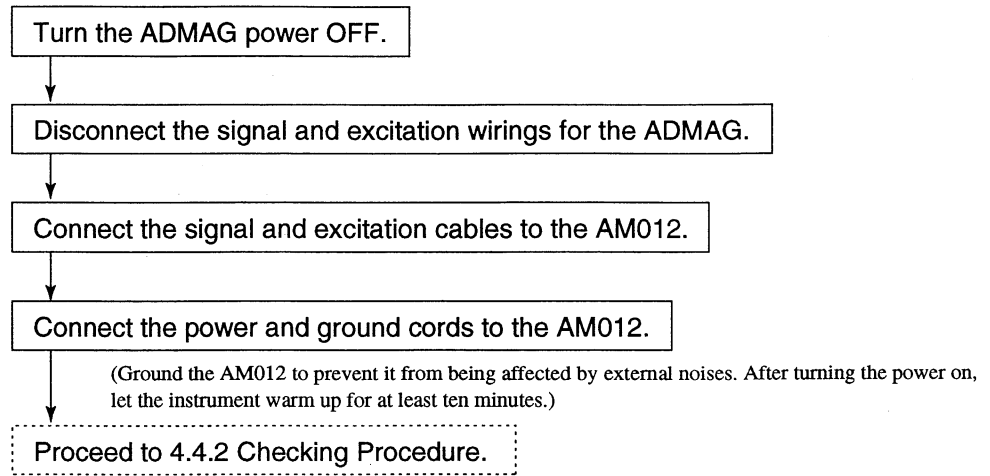
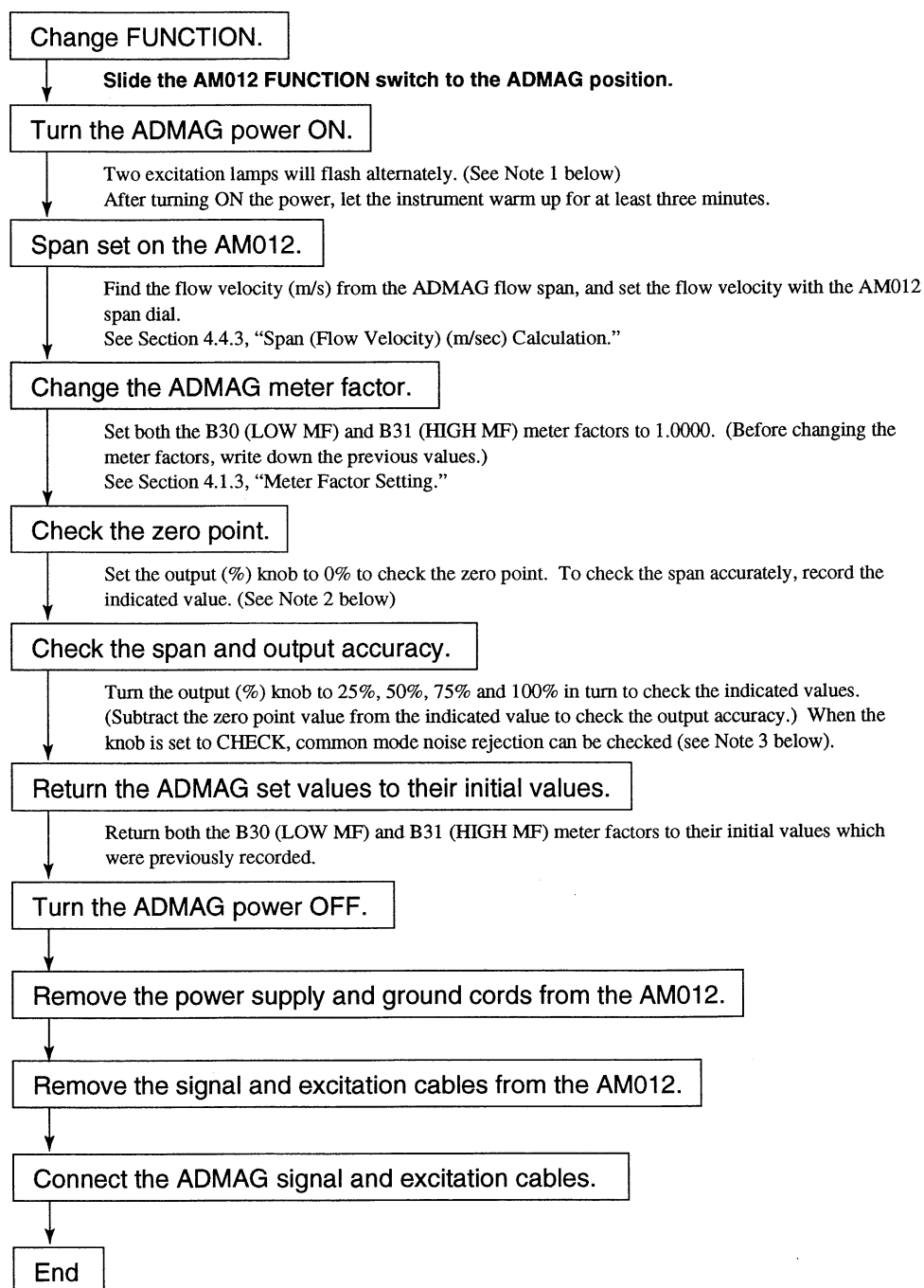


Figure 4.4.1 Interconnection Diagram

4.4.2 Checking Procedures



Note 1 : If no exciting current flows, the two excitation lamps do not flash correctly.

Note 2 : When the flowmeter is completely filled with liquid that is at a standstill, make an automatic ADMAG zero adjustment. If stopping the liquid flow is not possible, do not make an automatic ADMAG zero adjustment.

Note 3 : A common mode noise signal equivalent to a set value with the span-setting dial is output from the AM012.

4.4.3 Span (Flow Velocity) (m/sec) Calculation

Three types of flow velocity calculations are described below.

The parameters required for the calculations are listed in Table 4.4.1.

Table 4.4.1 Parameter Menu

Parameter Menu	Name	Abbreviation
B24 FLOW SPAN	Measurement flow span	F _S
B21 NOMINAL SIZE	Flowmeter nominal size	D
B22 FLOW UNIT	Flow unit	U _Q
B23 TIME UNIT	Time unit	U _T

(1) For Flow Units

(i) When a Flowmeter Nominal Size Unit is mm.

Set the B20 SIZE UNIT in “mm” and B21 NOMINAL SIZE with “D”.

$$V[\text{m/s}] = \frac{F_S \times U_Q}{(D/2 \times 10^{-3})^2 \times \pi \times U_T}$$

where F_S : B24 FLOW SPAN
D : B21 NOMINAL SIZE
U_Q : B22 FLOW UNIT
U_T : B23 TIME UNIT

Table 4.4.2 Flow Unit

B22 FLOW UNIT	U _Q
K m ³	10 ³
m ³	1
l	10 ⁻³
cm ³	10 ⁻⁶
M gal	3.78541×10 ³
K gal	3.78541
gal	3.78541×10 ⁻³
m gal	3.78541×10 ⁻⁶
K bbl	1.58987×10 ²
bbl	1.58987×10 ⁻¹
m bbl	1.58987×10 ⁻⁴
μ bbl	1.58987×10 ⁻⁷

Table 4.4.3 Flow Unit

B23 TIME UNIT	U _T
/d	86400
/h	3600
/m	60
/s	1

(ii) When the Flowmeter Nominal Size is expressed in inches.

When the flowmeter nominal size is expressed in inches, convert the units in inches to mm and obtain the flow velocity (see Table 4.4.4).

Table 4.4.4

Nominal Size in inches	Nominal Size in mm
0.1 (1/10)	2.5
0.20 (1/5)	5
0.40 (3/8)	10
0.50 (1/2)	15
1.00 (1)	25
1.50 (1-1/2)	40
2.00 (2)	50
3.00 (3)	80
more than size 4 inches (shown by n)	25 × n

(2) For Units in Feet (ft)

$$V \text{ (m/sec)} = F_s \times 0.3048$$

where F_s : B24 FLOW SPAN

(3) For Units in [m/sec]

$$V \text{ [m/sec]} = F_s$$

where F_s : B24 FLOW SPAN

4.4.4 Meter Factor Setting

The meter factors can be set using four ADMAG converter keys. Data can be set with the M10 TUNING in the ENABLE position. Set the display menu to B30 LOW MF with the [SHIFT] and [INC] or [DEC] key. Then set the meter factor to 1.0000 with the [SHIFT] and [INC] or [DEC] and [SET] keys.

ADMAG requires two meter factors. So, set the meter factor to 1.0000 for B31 HIGH MF, too. For details, refer to the AM12A/B Instruction Manual IM 1E6C0-E, or the AM100A/B and AM200A/B Instruction Manual IM 1E6B0-1E.

4.5 When AM012 is used with YMA11

4.5.1 Interconnections

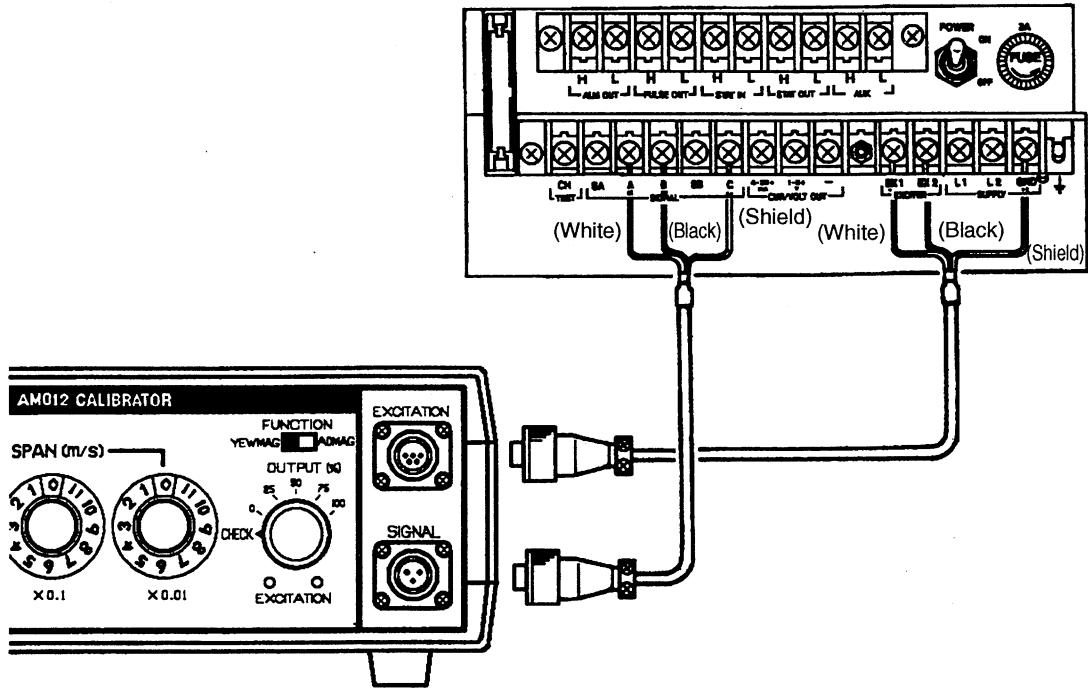
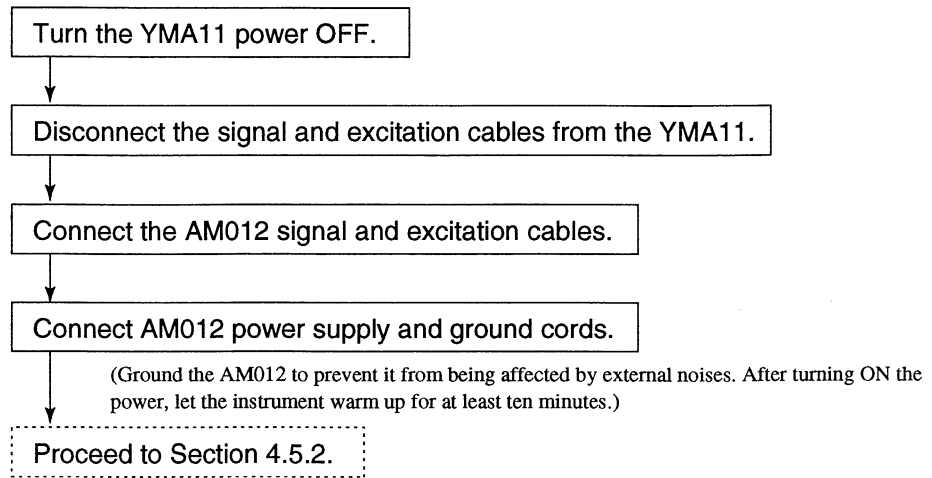
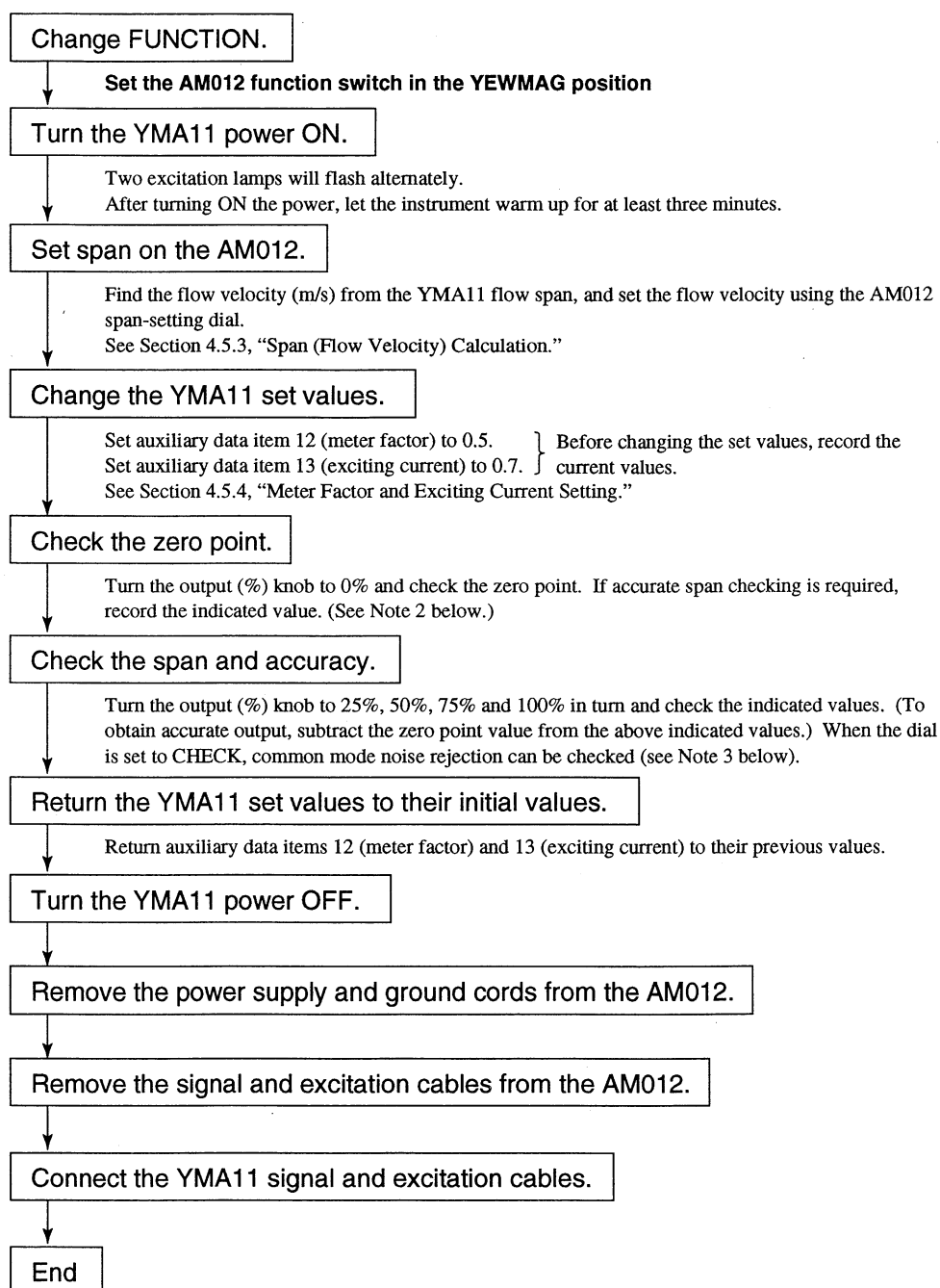


Figure 4.5.1 Interconnection Diagram

4.5.2 Checking Procedures



Note 1 : If no exciting current flows, the two excitation lamps do not flash correctly.

Note 2 : When the flowmeter is completely filled with liquid that is at a standstill, make an automatic ADMAG zero adjustment. If stopping the liquid flow is not possible, do not make an automatic ADMAG zero adjustment.

Note 3 : A common mode noise signal equivalent to a set value with the span-setting dial is output from the AM012.

4.5.3 Span (Flow Velocity) (m/sec) Calculation

The flow velocity is affected by the six parameters listed below:

Table 4.5.1 Parameter Menu and Name

Auxiliary Parameter No.	Name	Abbreviation
2—I	Nominal size unit	I
3—N	Flow unit	N
3—P	Time unit	P
4 to 7	Flow span	Q
8	Unit conversion factor	K
1	Nominal size	D

If the flowmeter size is expressed in inches, see (ii) on the next page.

(i) If the flowmeter nominal size (D) is expressed in mm:

Assign the required values to equation (1), and obtain the flow velocity.

$$v[\text{m/s}] = \frac{K \times Q \times N}{(D/2 \times 10^{-3})^2 \times \pi \times P} \dots\dots\dots (1)$$

- where K : Set value for auxiliary parameter No. 8.
- Q : Flowrate span to be calibrated, selected from among auxiliary parameter Nos.4 to 7.
- P : Values listed in Table 4.5.2.
- N : Values listed in Table 4.5.3.
- D : Nominal size set to auxiliary parameter No. 11.
- v : Flow velocity span

Table 4.5.2 Flow Time Units

Flow Time Units	P
0[h]	53600
1[<i>min</i>]	60
2[<i>sec</i>]	1

Table 4.5.3 Flow Units

Flow Unit Settings	N
0[m ³]	1
1[l]	10 ⁻³
2[cm ³]	10 ⁻⁶
3[10 ³ U.S.gallon]	3.78541
4[10 ⁰ U.S.gallon]	3.78541×10 ⁻³
5[10 ⁻³ U.S.gallon]	3.78541×10 ⁻⁶
6[10 ³ bbbl]	1.58987×10 ²
7[100bbbl]	1.58987×10 ⁻¹
8[10 ⁻³ bbbl]	1.58987×10 ⁻⁴

Example 1:

When flow units are expressed in m³/h and the unit conversion factor is 1:

$$v[\text{m/s}] = \frac{1 \times Q \times 3600 \times 1}{(D/2 \times 10^{-3})^2 \times \pi} = \frac{353.68 \times Q[\text{m}^3/\text{h}]}{D^2[\text{mm}]} \dots\dots\dots (a)$$

Example 2:

When flow units are expressed in l/min and the unit conversion factor is 1:

$$v[\text{m/s}] = \frac{1 \times Q \times 10^{-3}}{(D/2 \times 10^{-3})^2 \times \pi} = \frac{21.221 \times Q[\text{l}/\text{min}]}{D^2[\text{mm}]} \dots\dots\dots (b)$$

Assign the necessary values to equations (a) and (b) above and derive the span (flow velocity).

(ii) When the Flowmeter Nominal Size is expressed in inches:

Convert the flowmeter size expressed in inches to mm and obtain the flow velocity (m/sec) (see Table 4.5.4 and unit converting procedures (i) above.

Table 4.5.4

Nominal Size in inches	Nominal Size in mm
0.1 (1/10)	2.5
0.15 (5/32)	4
0.25 (1/4)	6
0.50 (1/2)	15
1.00 (1)	25
1.50 (1-1/2)	40
2.00 (2)	50
3.00 (3)	80
More than 4 inches (shown by n)	$25 \times n$

Example 1: When the flowmeter nominal size is 0.5 inches:

From the table above, we can obtain an approximate flowmeter size of 15 mm for 0.5 inches. Derive the flow velocity using equation (1) above.

Example 2: When the flowmeter nominal size is 4 inches:

From the above table, we can also obtain an approximate flowmeter size of 100mm ($25 \times 4 = 100$) for 4 inches. Derive the flow velocity using equation (1) above.

4.5.4 Meter Factor and Exciting Current Setting

Set the ENABLE/INHIBIT switch to ENABLE and auxiliary data item 27 to 77.

Use the data selection switch [▲], [▼] to call up auxiliary data item 12 (meter factor). Then press the [SHIFT], [INCR], [SET] keys and set item 12 to 0.5. Next, call up auxiliary data item 13 (exciting current) and set it to 0.7.

For details, see the YMA11 Instruction Manual IM 1E4B0-01E, Section 5.4.

4.6 When AM012 is used with Compact YEW MAG

When the AM012 and Compact YEW MAG (CYM for short) are combined, special connectors are needed. Specify the (/CYM) options, and cables with special connectors are supplied.

4.6.1 Interconnections

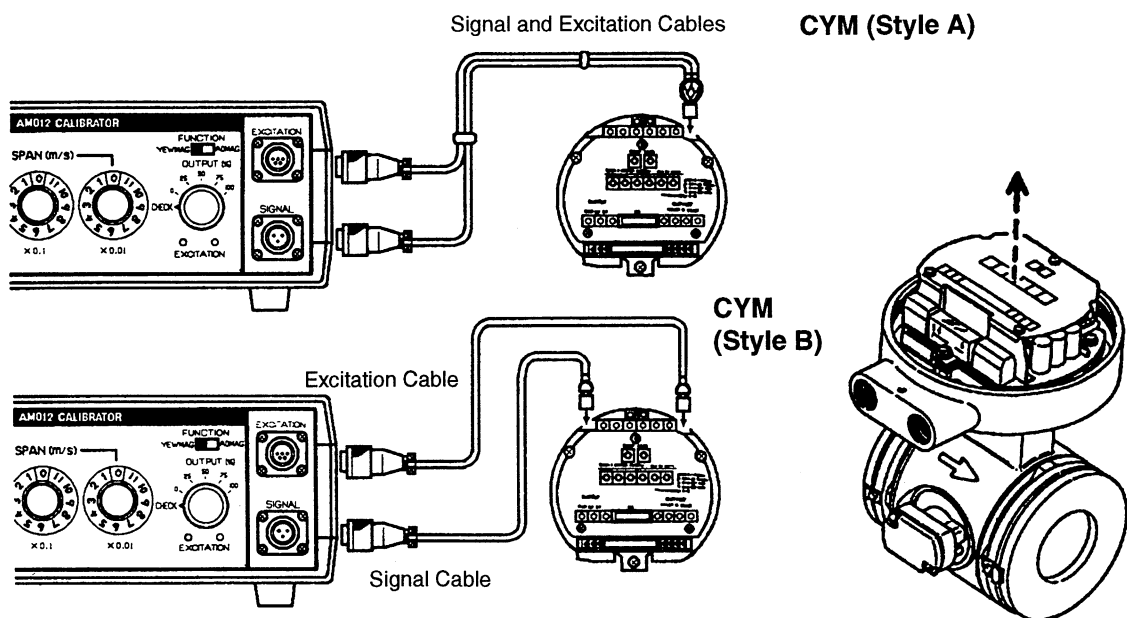
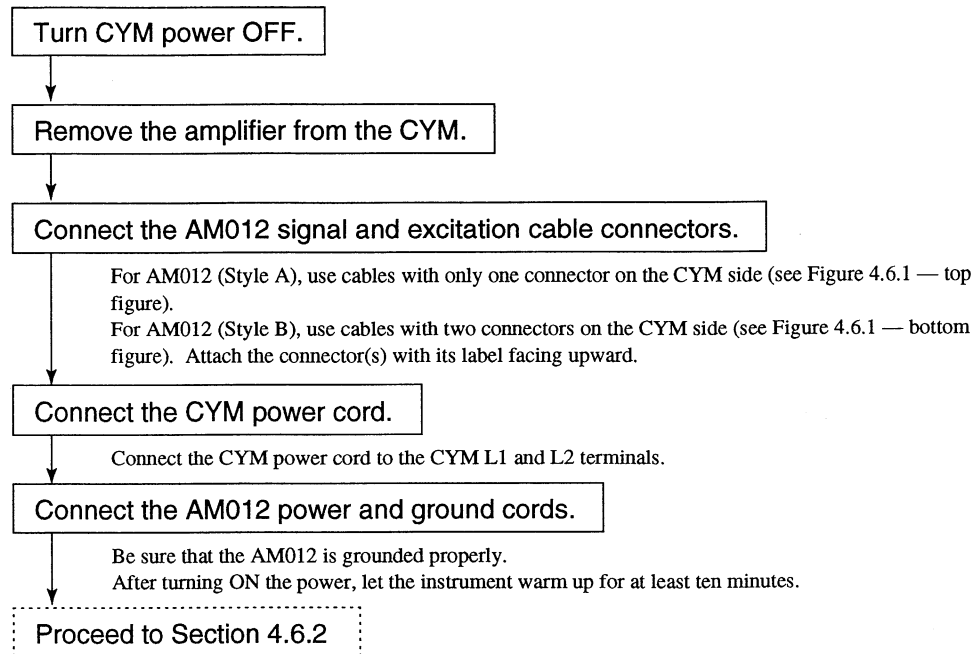
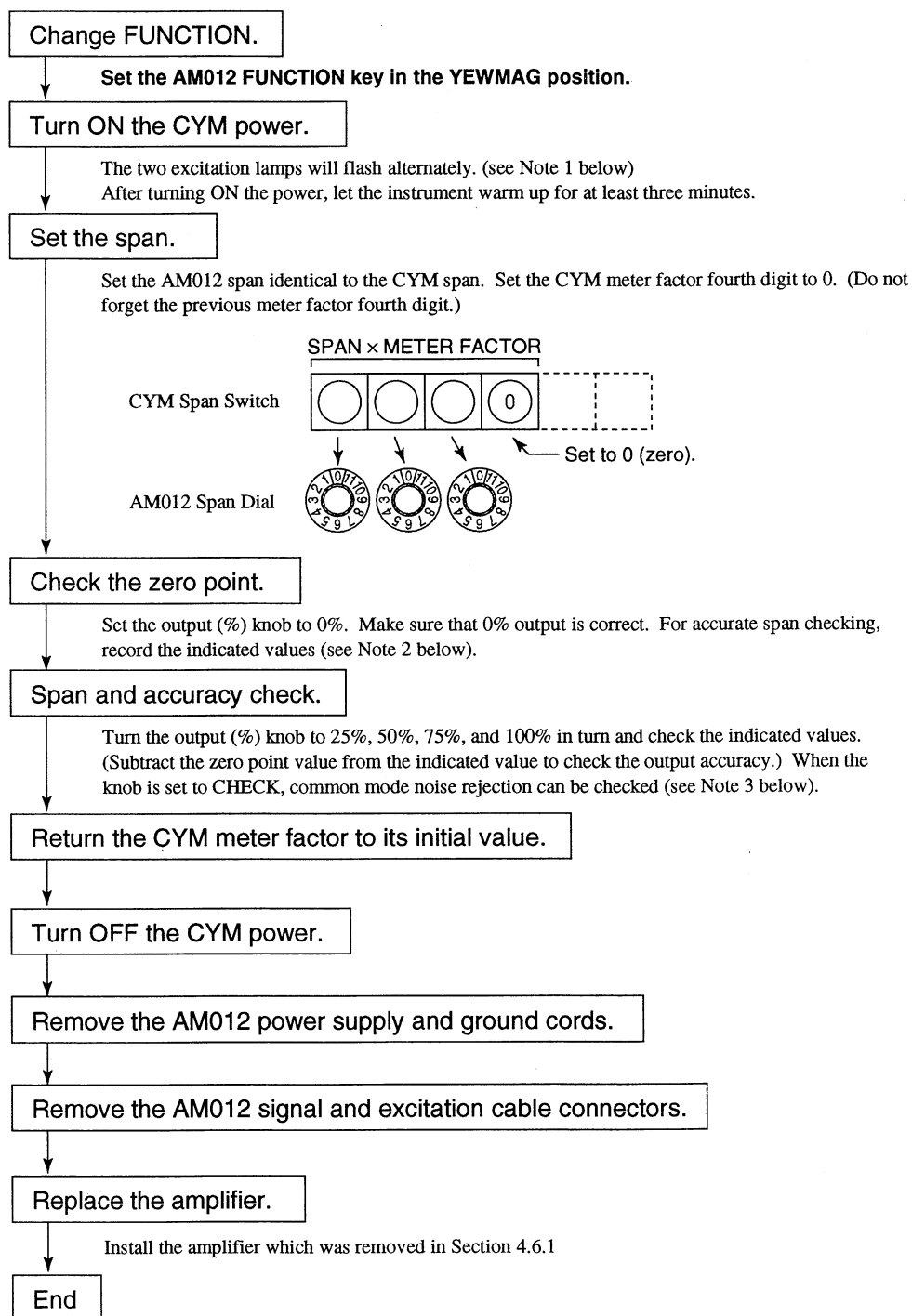


Figure 4.6.1 Interconnection Diagram

4.6.2 Checking Procedures



Note 1 : If no exciting current flows, the two excitation lamps do not flash correctly.

Note 2 : When the flowmeter is completely filled with liquid that is at a standstill, make an automatic CYM zero adjustment. If stopping the liquid flow is not possible, do not make an automatic CYM zero adjustment.

Note 3 : A common mode noise signal equivalent to a set value with the span-setting dial is output from the AM012.