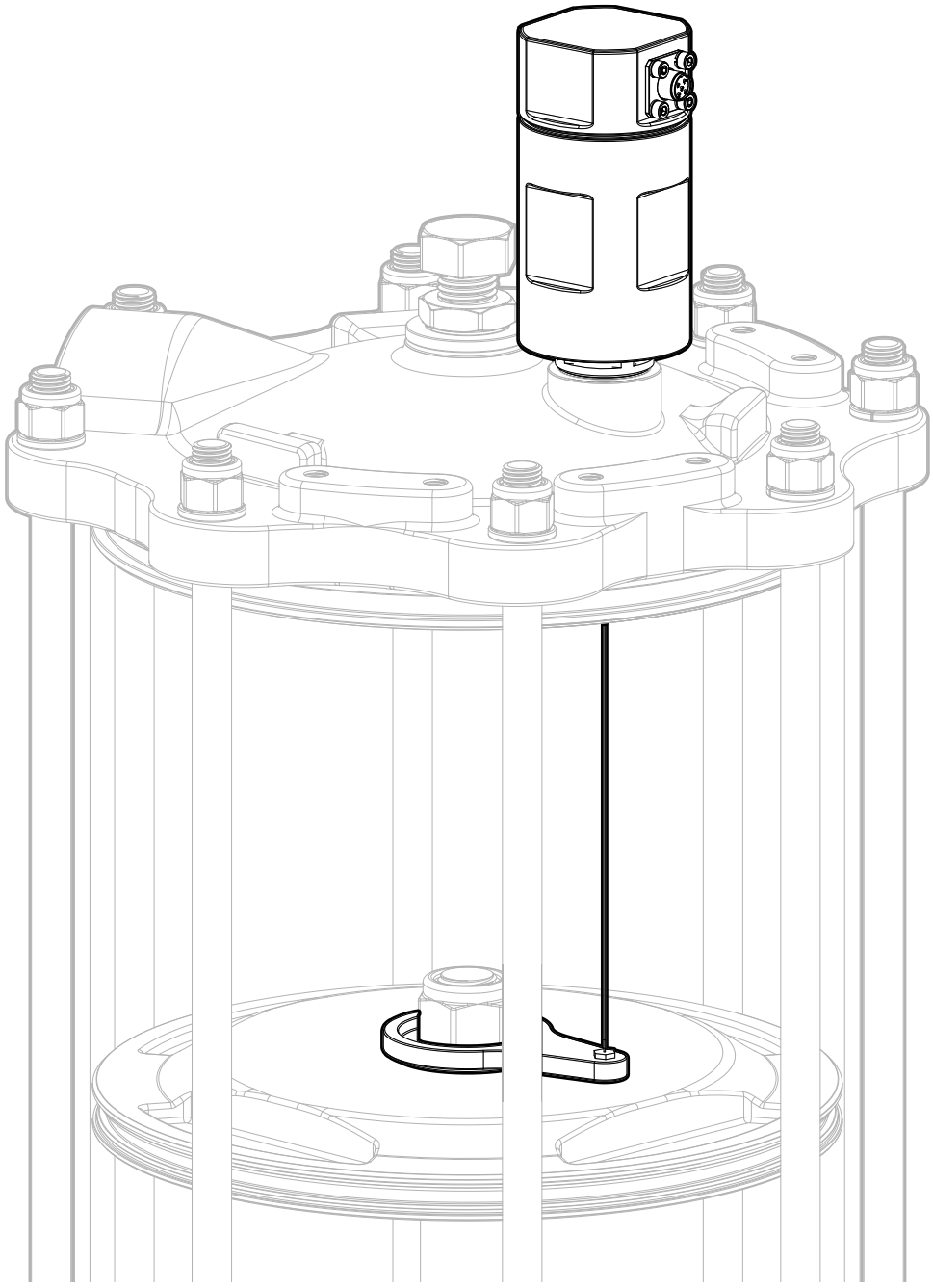
SERIES KCA

LINEAR POSITION SENSOR

Installation, Operation, and Maintenance Manual



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CONTENTS

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1.0 DEFINITION OF TERMS

All information within this manual is relevant to the safe operation and proper care of your Bray product. Please understand the following examples of information used throughout this manual.

Specific instructions for non-standard materials of construction, temperature range, etc. should be referred to the factory.

1.1 Safety Statements

To prevent unwanted consequences, standard symbols and classifications are used as shown below:

DANGER
Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
Used without the safety alert symbol, indicates a potential situation which, if not avoided, may result in an undesirable result or state, including property damage.

NOTE: Provides important information related to a procedure.

2.0 INTRODUCTION

The Bray KCA sensor is a cable-actuated linear position sensor designed for use with Bray knife gate valve actuators. It provides an analog current output, available in either 4-20mA or 0-20mA range, as well as a 0-10V voltage output, corresponding to the valve's open, closed and intermediate positions.

Additional **product information** (such as application data, engineering specifications, actuator selection, etc.) is available from your local Bray distributor or sales representative, or online at **BRAY.COM.**

For a detailed list of product certifications, please contact your local Bray representative.

3.0 BACKGROUND

The KCA sensor uses an absolute encoder sensor to measure the distance between an object and a point of reference, as well as changes in position. The sensor converts displacement into an electrical output. The linear-to-rotary-to-linear (LRL) mechanism forms the axis of a recoil spool mechanism.

The spool uses a polymer-coated, stainless-steel cable to form a reliable, repeatable coupling between the piston and the sensor. Anchoring the connector to the piston causes the cable to wind or unwind from the spool as the piston rod retracts or extends, respectively. The assembly also offers extreme immunity to shock, vibration, and environmental factors, regardless of stroke length.

4.0 PROCEDURE FOR DISASSEMBLING THE EXISTING ACTUATOR

1. Ensure the piston rod (80) is fully retracted into the cylinder (50) by applying air at 5 bar (75 psi) pressure through the bottom port (70) and stop the air supply when the piston rod hits the stopper bolt (90). Refer **Figure 1.**

WARNING
Ensure the pressurized air is completely released from the actuator before disassembling the actuator.

Figure 1: Parts Callouts

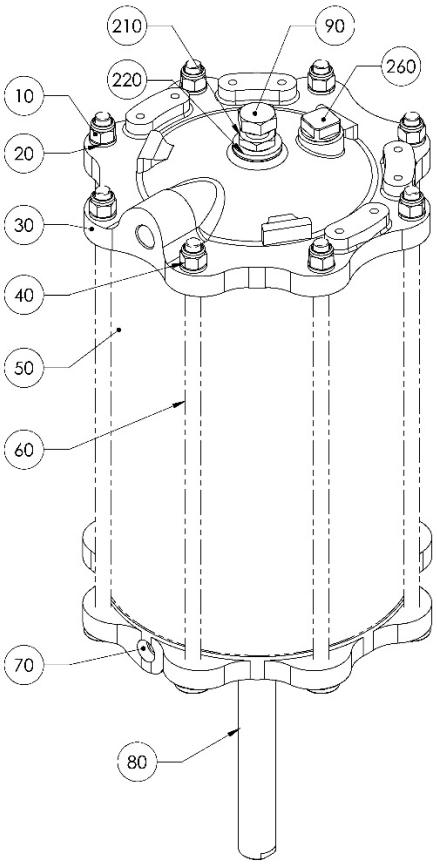
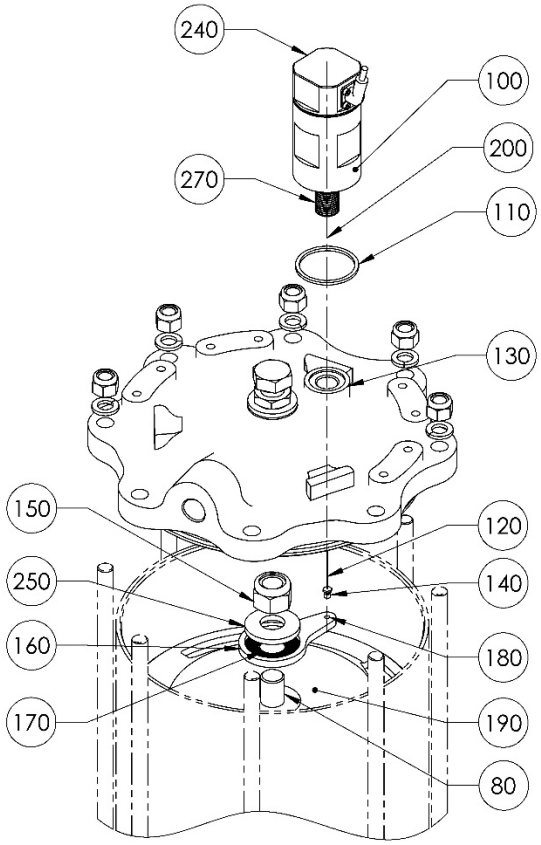


Figure 2: Parts Callouts



2. Position marking on the actuator cap (30) and cylinder (50).

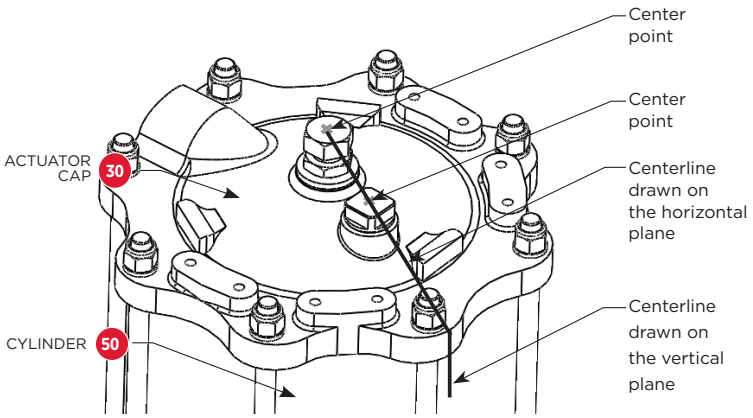


Figure 4a

2.1 Mark center points on the top faces of the stroke adjustment bolt (90) and dummy plug (260) as shown in **Figure 4a**.

2.2 Using a marker pen and steel rule, connect the center points and draw a line on the actuator cap (30) in the horizontal plane.

2.3 Project the same line onto the vertical plane and mark it on the cylinder (50) as shown in **Figure 4a.**

2.4 Ensure that the drawn lines remain visible and are not erased until the sensor kit assembly is completed, as these markings will be used for alighning the adaptor (160) during the adaptor (160) installation steps.

3. Remove the Nylock nuts (10). Refer **Figure 1.**

4. Remove the Washers (20). Refer **Figure 1.**

5. Remove the Actuator Cap (30). Refer **Figure 1.**

6. Remove the Piston rod lock nut (150). Refer **Figure 2.**

7. Remove Dummy plug (260) from the Actuator Cap (30). Refer **Figure 1.**

Note: In the old actuator cap (30) design, the dummy plug provision is not available, in such cases, replace the old actuator cap (30) with a new one.

5.0 PROCEDURE FOR ASSEMBLING THE POSITION SENSOR KIT ON THE ACTUATOR

1 Ensure if the existing Actuator Cap (30) has a M24 tapped hole as shown in **Figure 4**. If the M24 tapped hole is not available on the existing Actuator Cap (30), replace with a new Actuator Cap (30) which has a M24 tapped hole as shown in **Figure 4.**

2 Ensure the Gasket (110) is installed between the Sensor housing (100) and the Actuator cap (30) as Refer **Figure 3a.** Apply thread sealant (Loctite 542) on the Housing external threads (270).

3 Carefully remove the dummy cap (22) from housing thread.

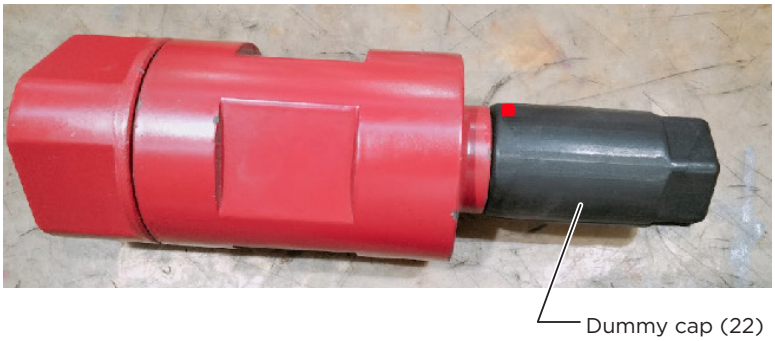


Figure 3: KCA Cross Section

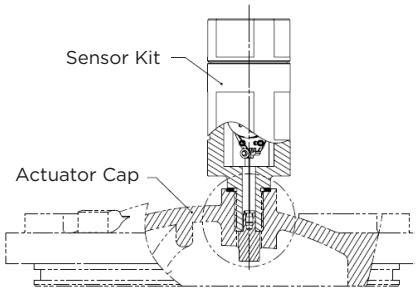
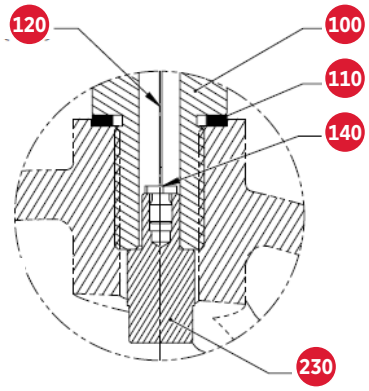
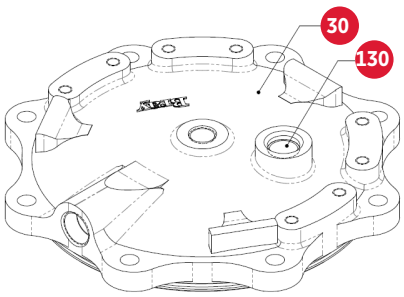


Figure 3a: Gasket position



100	Sensor Housing
110	Gasket
120	Sensor Wire
140	Clamping Screw
230	Cable Retainer

Figure 4:



30	Actuator Cap
130	M24 Tapped Hole

4 Install the KCA sensor kit (240) onto the actuator cap (30), ensure the housing is securely tightened onto the actuator cap (30) at the threaded joints to a torque of 18Nm, Refer **Figure 3.**

CAUTION
Improper tightening may cause air leakage through threaded joints.

5 The actuator cap (30) and KCA sensor kit (240) as a subunit, ready to be installed onto the actuator unit. Refer **Figure 3.**

6 Install the adaptor (160) on the piston of the actuator unit. Ensure the centerline marked on the adaptor (160) aligns with the line marked on the cylinder (50) prepared in section 4, step 2, Refer **Figure 4a & 4b.**

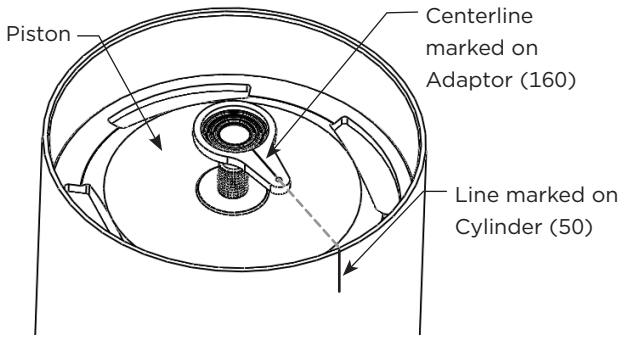


Figure 4b

7 Install the Belleville washer (250) on the adaptor (160). Refer **Figure 2.**

8 Install the piston rod Nylock nut (150) and tighten it to the torque specified in **Table-1** . Ensure the adaptor (160) alignment remains unchanged while tightening the nut (150).

9 Place the subunit (sensor kit + actuator cap) prepared in Step 5, over the actuator unit. Hold the subunit firmly in position until the clamping screw (140) is securely fastened to the adaptor tapped hole (180).

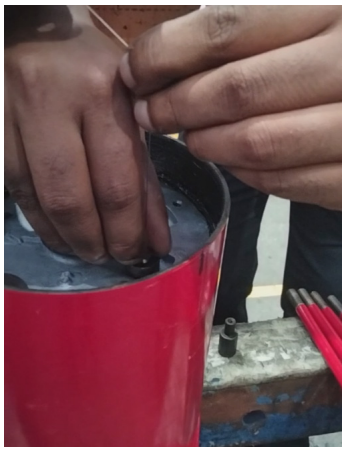
10 Pull out the cable retainer (230) from the bottom of actuator cap (30) slowly and carefully to a distance to ease the next assembly steps.

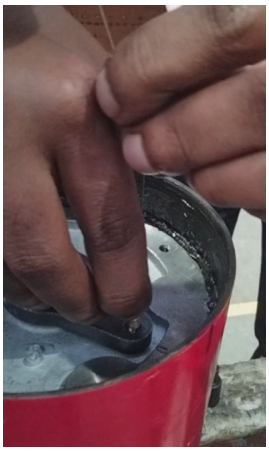
CAUTION
900 mm is the maximum stroke length for the sensor. Pulling the sensor cable beyond 900 mm may damage the wire.

11 Remove the cable retainer (230) from the clamping screw thread (140). While removing, ensure the sensor cable (120) is not twisted. To prevent cable (120) twisting, hold the clamping screw head (140) with one hand and rotate the cable retainer (230) anticlockwise with the other hand until the cable retainer (230) is completely detached from the clamping screw (140).

CAUTION
Do not release the clamping screw (140) until it is fully secured to the adaptor tapped hole (180). If the clamping screw (140) is released prematurely, the sensor cable (120) may spring back and retract into the housing (100), which could make it impossible to extend again.

12 Hand tighten the clamping screw (140) into the adaptor tapped hole (180). While tightening, ensure there is no tension in the sensor cable (120). To release the tension, hold the cable (120) with one hand to maintain slack, and tighten the clamping screw (140) with the other hand.





CAUTION
Do not turn the clamping screw (140) more than 10 turns. Excessive turns may cause the cable (120) to twist while tightening.

13 Connect the actuator cap (30) to the cylinder (50) using tie rods (60). Ensure the actuator cap O-ring is properly seated in the O-ring groove of the actuator cap (30) before tightening the tie rod nuts (10).

14 Install the washers (20).

15 Install the Nylock nuts (10) and tighten them to the torque specified in **Table-2.**

16 Install the stroke adjustment bolt (90), Jam nut (210) and Thread seal (220) onto the actuator cap (30). Ensure the stroke adjustment bolt (90) is set to the required valve stroke length.

17 Ensure the clevis-to-piston rod joint locknut is fully tightened to the torque specified in **Table-1** before operating the valve with the actuator and sensor kit assembly. Refer **Figure 4c.**

CAUTION
If the locknut is not properly tightened, the piston may rotate during operation, which can lead to sensor cable damage.

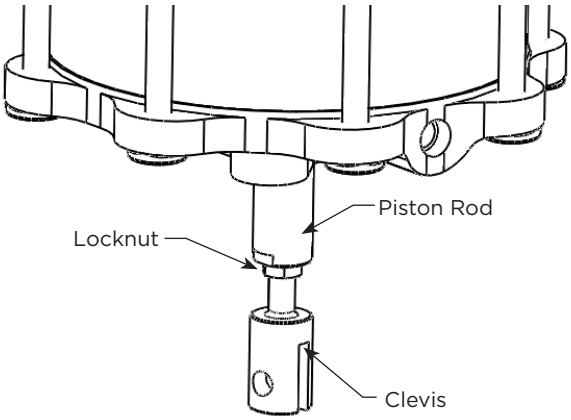


Figure 4c

TABLE - 1

ACTUATOR SIZE	TORQUE (NM)
C4	21
C6	24
C8	40
C10	44
C12	50
C14	58
C16	64
C20	90
C24	200

TABLE - 2

ACTUATOR SIZE	TORQUE (Nm)
C4	16
C6	22
C8	22
C10	27
C12	27
C14	27
C16	60
C20	60
C24	60

6.0 PROCEDURE TO DISASSEMBLE THE ACTUATOR CAP WITH POSITION SENSOR KIT AND ADAPTOR FROM THE ACTUATOR (TO CARRY OUT ANY REPAIR WORK)

1. Ensure the piston rod (80) is fully retracted into the cylinder (50) by applying air at 5 bar (75 psi) pressure through the bottom port (70) and stop the air supply when the piston rod hits the stopper bolt (90). Refer to Figure 1.
2. Ensure the pressurized air is completely released from the actuator before disassembling the actuator.
3. Follow section 4, steps 2.1 to 2.4 and mark the positions on the actuator cap (30) and cylinder tube (50) as shown in Figure 4a
4. Remove the Nylock nuts (10). Refer to Figure 1.
5. Remove the Washers (20) and Tie rods (60) Refer to Figure 1.
6. Slowly lift the Actuator cap (30) vertically upward from the cylinder (50) to a height within 800mm from the adaptor (160) as shown Figure 11 and hold the actuator cap (50) steadily in the same position. If required use a lifting device or support fixture to maintain the actuator cap (50) in this raised position.

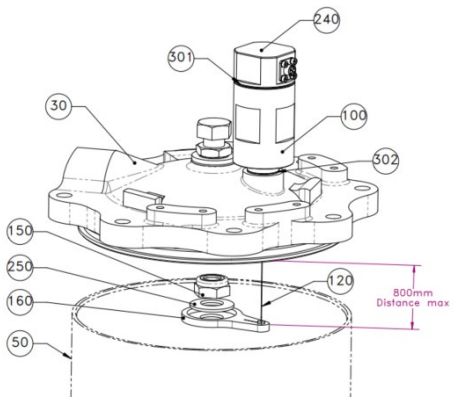


Figure 11

CAUTION
The sensor cable is connected with piston (190) and adaptor (160) and it remains under tension during lifting. Do not lift the actuator cap more than 800mm from the adaptor (160) as shown in Figure 11. Lifting beyond this limit can stretch or break the sensor cable (120) resulting in permanent sensor damage.

CAUTION
When lifting the Actuator cap (50), do not twist or rotate cap. Any twisting motion will transmit torque to the sensor cable (120), potentially causing damage to the cable (120).

7. Remove the piston rod lock nut (150) and ensure the sensor cable (120) is not disturbed during locknut (150) removal. Refer to Figure 11.

8. Carefully lift and remove the Adaptor (160) from piston rod (80), while removing, ensure that the sensor cable (120) remains connected to the adaptor and lift the adaptor together with the sensor cable. Ensure that the sensor cable is not twisted or damaged during this operation. Refer to Figure 11.
9. Remove the Actuator cap (30) together with sensor kit and adaptor (160) as a single assembly and place the removed assembly on a stable surface to avoid any damage to the sensor cable (120). Refer to Figure 11

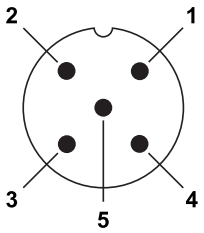
CAUTION
Do not remove the sensor cable (120) from the adaptor (160), the sensor cable is under internal spring tension and may retract suddenly into the housing (100) which could make it impossible to extend again.

7.0 CALIBRATION OF THE POSITION SENSOR

1 Ensure that the actuator equipped with position sensing system is assembled with valve before starting the position sensor calibration process.

2 Refer the Pin diagram shown in **Figure 5.**

Figure 5: M12 Connector



PIN	Signal Analog	
1	I_{OUT}/U_{OUT}	(Brown)
2	+UB	(White)
3	GND	(Blue)
4	Limit 1	(Black)
5	Limit 2	(Gray)

3 Connect the 24V DC source positive terminal to Pin 2 (White lead) and negative terminal to Pin 3 (Blue lead).

4 Connect the Loop calibrator or Multimeter positive terminal to Pin 1 (Brown lead) and negative terminal to Pin 3 (Blue lead).

5 Operate the actuator and monitor the change in output signal measured through Loop calibrator or Multimeter.

6 Disconnect the Loop calibrator or Multimeter.

7 Operate the actuator to the fully open position and mate Pin 2 (White lead) with Pin 4 (Black lead) for more than 6 sec and remove the Black lead (Open Limit Teaching).

8 Operate the actuator to the fully close position and mate Pin 2 (White lead) with Pin 5 (Gray lead) for more than 6 sec and remove the Gray lead (Close Limit Teaching).

9 Connect the loop calibrator or Multimeter positive and negative terminals to Pin 1 (Brown Lead) and Pin 3 (Blue Lead) respectively, check the readings by operating the actuator (full stroke).

10 With output signal range of 4-20mA, ensure 4mA and 20mA are measured at the corresponding endpoints of the actuator stroke. If using the 0-20mA output option, verify that 0mA and 20mA are measured at the endpoints of the stroke.

10.1 When using the 0-20mA output option, ensure 0mA measured at closed position and 20mA measured at Open position of the actuator stroke.

10.2 When using the 4-20mA output option, ensure 4mA measured at closed position and 20mA measured at Open position of the actuator stroke.

10.3 When using the 0-10VDC output option, ensure 0V measured at closed position and 10V measured at Open position of the actuator stroke.

8.0 INTEGRATION OF POSITION SENSOR WITH SERIES 6A POSITIONER USING THE AIM MODULE [6A6DR4-0048F]

1 Calibrate the actuator position sensor. Ensure it provides 0-20ma output for open and closed.

2 Wire the KCA sensor to the S6A positioner as shown in the wiring diagram **Figure 8 (**pg. 11**)**.

3 Configure the AIM module switch block as shown in **Table 1.**

Table 1: Configuration

Measuring Range	Switch Block 1		Switch Block 2			
	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4
20 mA	OFF	OFF	ON	OFF	ON	OFF

4 Plumb the actuator and positioner.

5 Power on the positioner by providing a 4 to 20mA signal.

NOTE: Make sure the signal does not turn off during the commissioning.

6 With the positioner in manual mode, check the full stroke using the up and down buttons. This step is taken to ensure the positioner is able to operate the actuator to the full stroke of the actuator.

7 Position the valve to 50% open condition using the positioner.

8 Set parameter “YCLS” to “uP do” for tight closing.

9 Set Parameter “YCDO” to “5” %.

10 Set Parameter “YCUP” to “95” %.

11 Set parameter YFCT to “LWAY”.

12 Call the “4. INITA” parameter. The display shows per **Figure 6.**

To begin the initialization process, go to parameter 4 and press and hold the UP button for at least 5 seconds until the display appears as shown in **Figure 7.** Keep holding until “Run1” is displayed. During the automatic initialization, the positioner will go through several steps, which are indicated on the lower line of the display. The duration of the initialization process varies depending on the actuator used and can take up to 15 minutes.

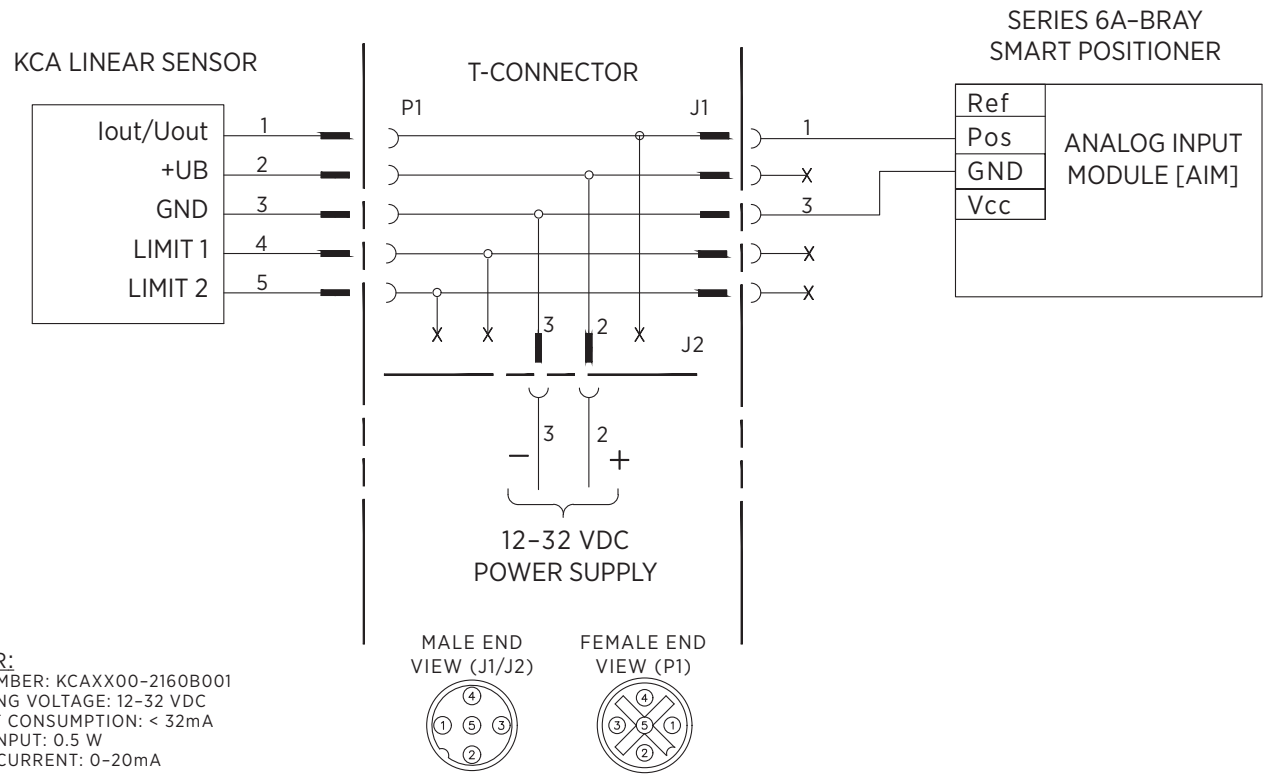
13 The display, as shown in **Figure 9**, indicates that the initialization is complete.

Figure 6: Initialization parameter

Figure 7: Starting automatic initialization

Figure 9: Initialization was completed successfully

Figure 8: Wiring Diagram



SENSOR:
PART NUMBER: KCAXX00-2160B001
OPERATING VOLTAGE: 12–32 VDC
CURRENT CONSUMPTION: < 32mA
POWER INPUT: 0.5 W
OUTPUT CURRENT: 0–20mA

6A POSITIONER:
AIM MODULE PART NUMBER: 6A6DR4-0048F
RATED SIGNAL RANGE: 0–20mA
INTERNAL LOAD RB: 200 OHM
STATIC DESTRUCTION LIMIT: 40mA

T-CONNECTOR:
PART NUMBER: 990000-09067000
RATED VOLTAGE: 48 V
CURRENT: 4 A
INSULATION RESISTANCE: ≥ 10^8 OHM

9.0 SAFETY MESSAGES

All safety messages in the instructions are flagged with the word Caution, Warning or Danger. These messages must be followed exactly to avoid equipment damage, personal injury, or death.

CAUTION
Ensure the actuator is depressurize and de-energize before disassembling it.

CAUTION
Do not pull or release the sensor wire (120) suddenly, because the sensor wire (120) is subjected to tension force when it is being pulled and a sudden release of the sensor wire (120) can cause damage to the sensor (100) and the sensor wire (120). Hence, it is necessary to ensure that the sensor wire (120) is pulled and released slowly and carefully to avoid damage.

CAUTION
If the actuator is pressurized and the gasket sealing the sensor to the actuator cap port is improperly installed, it can lead to air leakage through the actuator cap port. This may cause the actuator to malfunction. Ensure that the gasket is installed correctly, then gradually pressurize the cylinder and check for any leaks.

WARNING
Do not remove the KCA sensor cover when the actuator is under pressure. The threaded cover serves as an anti-blowout mechanism for the sensor. If the cover is not properly installed before pressurizing the actuator, the sensor could be ejected from its enclosure. Therefore, it is crucial to ensure that the housing cap is securely in place before applying pressure to the actuator.

CAUTION
Do not tilt the Actuator Cap (30) after the Adaptor (160) is fully tightened (stated in step 4.11), because any tilting movement of Actuator Cap (30) can cause damage to the Sensor Wire (120). Hence it is necessary to ensure that the Actuator Cap (30) is not tilted after the Adaptor (160) is tightened with the Piston rod (80).

CAUTION
Do not extend the cable beyond the specified maximum extension length.

CAUTION
For proper functioning do not squeeze or bend the cable.

CAUTION
All lines for connecting the sensor must be shielded.

CAUTION
Switch on operating voltage together with downstream electronics (e.g control unit).

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