Macurco™ CX-6, CX-12

Carbon Monoxide & Nitrogen Dioxide Combination Detector, Controller and Transducer

User Instructions

IMPORTANT: Keep these user instructions for reference.

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1 General Safety Information

The following instructions are intended to serve as a guideline for the use of the Macurco CX-6 and CX-12 Carbon Monoxide & Nitrogen Dioxide Combination Detector. This manual will refer to these devices as CX-xx unless content is specific to a model. This manual is not to be considered all-inclusive, nor is it intended to replace the policy and procedures for your facility. If you have any doubts about the applicability of the equipment to your situation, consult an industrial hygienist or call Technical Support at 1-844-325-3050.

1.1 General Description

The Macurco CX-xx is a commercial style combination Carbon Monoxide and Nitrogen Dioxide Gas Detector/Transducer. It is an electronic detection system used to measure the concentration of CO and NO_2 and provide feedback and automatic exhaust fan control to help reduce CO and NO_2 concentrations in parking garages, maintenance facilities or other commercial applications.

It is available in both a low voltage (CX-6) and line voltage (CX-12) option. The CX-xx is a low-level meter capable of displaying in the range 0-200 ppm (parts per million) of Carbon Monoxide and 0-20 ppm of Nitrogen Dioxide. The CX-xx has selectable 4-20 mA output, buzzer and digital display options. The CX-xx is factory calibrated and 100% tested for proper operation but can also be calibrated in the field.

The CX-xx is intended to be mounted on a 4 x 4 electrical box. It can operate in a stand-alone application or can be connected to a building automation system, UL listed Control Panel, or other control device that accepts 4-20mA analog input. The CX-xx is compatible with the Macurco DVP Control Panel.

1.2 List of warnings

⚠WARNING
Each person using this equipment must read and understand the information in this user manual before use. Use of this equipment by untrained or unqualified persons or use that is not in accordance with this user manual, may adversely affect product performance.
Use only for monitoring the gas which the sensor and monitor is designed to detect. Failure to do so may result in exposures to gases not detectable and cause serious injury or death. For proper use, see supervisor or user manual, or contact Technical Support at 1-844-325-3050.
This equipment may not function effectively below 0°F or above 125°F (-18°C or above 52°C). Using the detector outside of this temperature range may adversely affect product performance.
This detector helps monitor for the presence and concentration level of a certain specified airborne gas. Misuse may produce an inaccurate reading, which means that higher levels of the gas being monitored may be present and could result in overexposure and cause serious injury or death. For proper use, see supervisor or User manual, or contact Technical Support at 1-844-325-3050.
High voltage terminals (120/240 VAC) are located within this detector, presenting a hazard to service technicians. Only qualified technicians should open the detector case

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and service the internal circuits. Ensure power is de-energized from the detector relays prior to servicing the unit. Failure to do so may result in electrical shock.
Do not disassemble unit or attempt to repair or modify any component of this instrument. This instrument contains no user serviceable parts, and substitution of components may impair product performance.
Using a certified gas with a concentration other than the one listed for this detector when conducting a calibration verification test (bump test) will produce inaccurate readings. This means that higher levels of the gas being monitored may be present and could result in overexposure. For proper use, see supervisor or User manual, or contact Technical Support at 1-844-325-3050.
The following steps must be performed when conducting a calibration verification test (bump test) to ensure proper performance of the monitor. Failure to do so may adversely affect product performance. • When performing a calibration verification test (bump test) only use certified calibration gas at the required concentration level. • Do not test with expired calibration gas. • Do not cover or obstruct display or visual alarm cover. • Ensure sensor inlets are unobstructed and are free of debris Failure to follow instructions outlined in this user manual can result in sickness or death.

2 Use Instructions and Limitations

⚠WARNING
Each person using this equipment must read and understand the information in this user manual before use. Use of this equipment by untrained or unqualified persons or use that is not in accordance with this user manual, may adversely affect product performance.

2.1 Use For

The CX-xx provides CO and NO_2 detection and automatic exhaust fan control for automotive maintenance facilities, enclosed parking garages, utility rooms, warehouses and other commercial applications where the potential for Carbon Monoxide and/or Nitrogen Dioxide gas exists. The CX-xx meets the requirements of the Uniform Building Code for enclosed garages and meets OSHA standards for CO and NO_2 exposure. The CX-xx can be used stand alone, with the Macurco DVP-120 Detection and Ventilation Control Panel, other 12 VAC or 24 VDC fire/security panels or building automation systems.

⚠WARNING
Use only for monitoring the gas which the sensor and monitor is designed to detect. Failure to do so may result in exposures to gases not detectable and cause serious injury or death. For proper use, see supervisor or user manual, or contact Technical Support at 1-844-325-3050.

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2.2 Do NOT use for

The CX-xx is not intended for use in hazardous locations or industrial applications such as refineries, chemical plants, etc. Do not mount the CX-xx where the normal ambient temperature is below 0°F or exceeds 125°F (-18°C or above 52°C). The CX-xx mounts on a type 4S electrical box supplied by the contractor. Do not install the CX-xx inside another box unless it has good air flow through it.

⚠ WARNING

This equipment may not function effectively below 0°F or above 125°F (-18°C or above 52°C). Using the detector outside of this temperature range may adversely affect product performance.

2.3 Features

- ETL LISTED Certified to CSA C22.2 No 61010-1, Conforms to UL Std. 61010-1
- Low-level meter capable of displaying from 0-200 ppm of CO and 0-20 ppm of NO_2
- The CX-xx meets the Uniform Building Code for enclosed garages and meets OSHA standards for CO and NO_2 exposure
- Selectable fan and alarm relay activation
- 5 A SPDT fan relay controls starters of exhaust fans
- 0.5 A N.O. or N.C. alarm relay connects to warning devices or control panels
- 4-20 mA Current Loop
- CX-xx mounts on a standard 4x4 electrical box and becomes cover for the box
- Supervised system: any internal detector problem will cause the fan & Alarm relay to activate
- Calibration kit is available. One screw allows access for calibration or gas test

2.4 Specifications

- Shipping Weight: 1 pound (0.45 kg)
- Size: 4 1/2 x 4 x 2 1/8 in. (11.4 X 11.4 X 5.3 cm)
- Color: White or Dark gray
- Connections: plugs/terminals
- Mounting box: (not included) 4x4 electric
- Fan relay: 5 A, 240 VAC, pilot duty, SPDT, latching or non-latching
- Fan relay actuation for CO: selectable at dIS (disable), 15, 25, 35 (default), 50 or 100 ppm
- Fan relay actuation for NO_2: selectable at dIS (disabled) 0.5, 0.7, 1.0, 1.2, 1.5, 1.7, 2.0, 2.2, 2.5 (default), 2.7, 3.0, 3.2, 3.5, 3.7, 4.0, 4.2, 4.5, 4.7, 5.0 ppm
- Fan Delay Settings of 0, 1, 3 (default), 5 and 10 minutes
- Fan Relay Minimum Runtime settings are 0 (default), 3, 5, 10 or 15 minutes
- Fan relay latching or not latching (default) selectable
- Alarm relay: 0.5A 120 V, 60 VA
- Alarm relay actuation: selectable N.O. (default) or N.C.
- Alarm relay settings for CO: dIS, 50, 100, 150, and 200 ppm (default)
- Alarm relay settings for NO_2: dIS, 1, 2, 3, 4, 5 (default), 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 ppm
- Current Loop 4-20 mA, selectable to 'bAS' (default), 'EnH', OFF

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- Calibration Period Settings: dis(default), 3, 6, 12 and 24 (months)
- Buzzer: 85 dBA at 10cm settable to On (default) or OFF.
- Digital display: 4-digit LED selectable to On (default) or OFF.
- Operating Environment: 0°F to 125° F (-18°C to 52°C),10 to 90% RH non-condensing

2.4.1 6-Series Low Voltage

- Power: 3 W (max) from 12 to 24 VAC or 12 to 32 VDC
- Current @ 24 VDC: 75 mA in alarm (two relays), 50 mA (fan relay only) and 23 mA standby

2.4.2 12-Series Line Voltage

- Power: 100-240VAC (50 TO 60 HZ)
- Current: 1.0 A MAX

3 Installation and Operating Instructions

⚠WARNING

This detector helps monitor for the presence and concentration level of a certain specified airborne gas. Misuse may produce an inaccurate reading, which means that higher levels of the gas being monitored may be present and could result in overexposure and cause serious injury or death. For proper use, see supervisor or User manual, or contact Technical Support at 1-844-325-3050.

3.1 Location

A CX-xx is normally mounted at breathing level, about 5 feet (1.5 meters) above the floor on a wall or column in a central area where air movement is generally good. The unit, on average, can cover approximately 5,000 sq. ft. (465 sq. meters) to 7,500 sq. ft. (697 sq. meters). The coverage depends on air movement within the room or facility. Extra detectors may be needed near any areas where people work or where the air is stagnant. Some of the factors that affect the coverage area are application type, personnel work areas and movement, room size, air movement, potential threat, mounting location, along with other site-specific factors that must be considered. Please check local regulations or requirements prior to installation. The CX-xx mounts on a 4x4 electrical box supplied by the contractor. Do not install the CX-xx inside another box unless it has good air flow through it. Do NOT mount the CX-xx where the normal ambient temperature is below 0°F or exceeds 125°F (below -18°C or above 52°C).

⚠WARNING

High voltage terminals (120/240 VAC) are located within this detector (CX-12), presenting a hazard to service technicians. Only qualified technicians should open the detector case and service the internal circuits. Ensure power is de-energized from the detector relays prior to servicing the unit. Failure to do so may result in electrical shock.

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3.2 Installation

3.2.1 6-Series Low Voltage

1. The CX-6 mounts on a 4" square (or 4x4) electrical box supplied by the contractor. Do not mount the CX-6 inside another box, unless it has good air flow through it.
2. Connect the CX-6 to Class 2 listed power supply only. It is suggested to use a separate transformer for powering the unit or units because of possible interferences from other devices on the same power supply.
3. Connect the CX-6 to the control cables with terminal plugs. When making connections, make sure the power is off.
4. There are two terminals for Power: 12 to 24 VAC or 12 to 32 VDC, with no polarity preference.
5. There are two terminals for the dry alarm relay contacts, again with no polarity preference. The alarm relay can switch up to 0.5 A 120 V, or 60 VA. The alarm relay is activated if gas reaches or exceeds the alarm settings. See section 4.5 Configuration "CON" for details on relay settings.
6. The alarm relay can be configured to normally open (default) (N.O.) or normally closed (N.C.) and will activate:
    a. if either the CO or NO_2 gas concentration exceeds the alarm set point. It will deactivate once the gas concentration drops below the alarm set point. Note that setting both "ArS.C" and "ArS.n" to "diS" will disable the alarm relay.
    b. during a power up test "PUt".
    c. when a trouble condition is present.
7. The dry contact, SPDT fan relay has three terminals. The common (COM.), normally open (N.O.) and the normally closed (N.C.) contact. The fan relay can switch up to 5.0 A up to 240 VAC. See section 4.5 Configuration "CON" for details on relay settings.
8. The Fan Relay can be configured for latching or non-latching (default) when activated (when the gas concentration exceeds fan relay set point). Once latched in, power will need to be interrupted or the "TEST" button pressed to un-latch the relay condition.
9. The Fan Relay will engage if the fan setting Carbon Monoxide or Nitrogen Dioxide concentration is exceeded for longer than the Fan Relay Delay time. Unless it is configured for latching, the fan relay will disengage once both of the following conditions have been met:
    - Carbon Monoxide and Nitrogen Dioxide concentration have dropped below fan setting
    - Fan Relay Run time has been exceeded

    Note that the "disable" fan setting will cause the fan relay to not engage. The fan relay will engage in trouble fault condition (if the Trouble Fan Setting Option is set to "ON") and will disengage once trouble fault condition is cleared.
10. The Current Loop is 4 mA in clean air and 4-20 mA for 0-200ppm CO and 4-20 mA for 0-20ppm NO_2. There are two terminals and polarity is marked on the connector.

NOTE: 22 to 12 AWG wire shall be used. Wire used shall meet the temperature range of the detector i.e. 0°F to 125° F (-18°C to 52°C).

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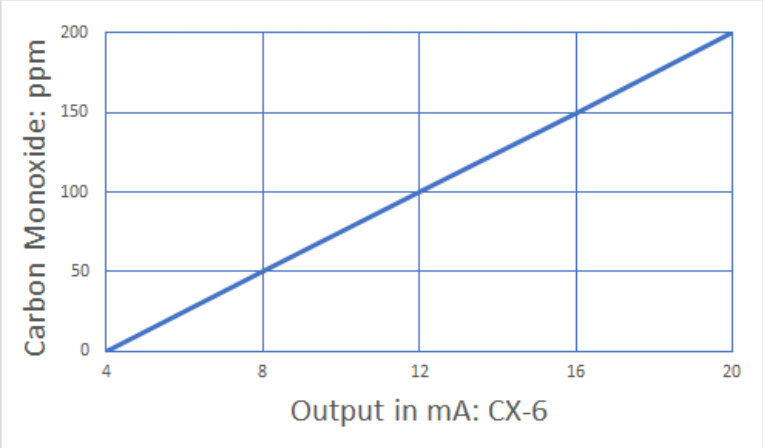

Figure 3–1 6-Series 4-20 mA CO Output diagram

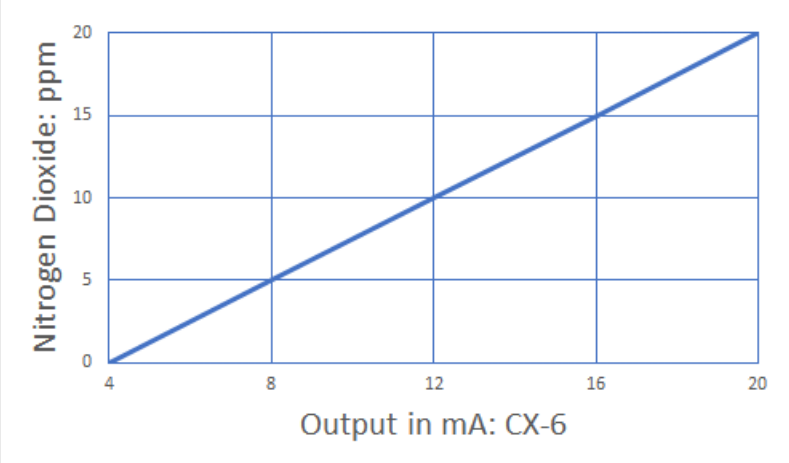

Figure 3–2 6-Series 4-20 mA NO2 Output diagram

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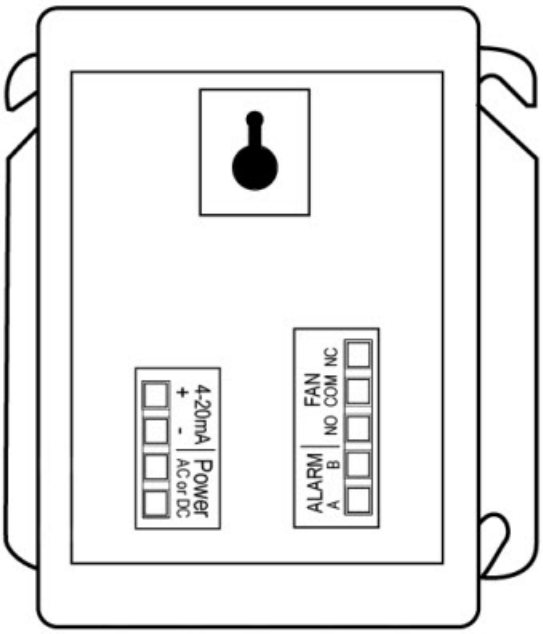

Figure 3–3 6-Series Rear View

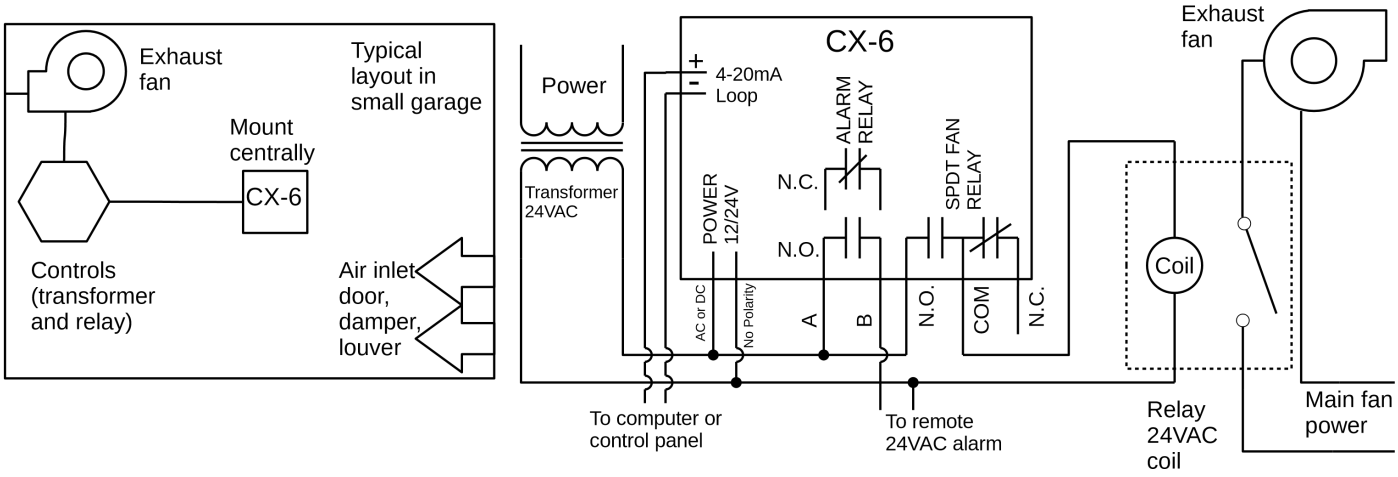

Figure 3–4 6-Series Typical Installation

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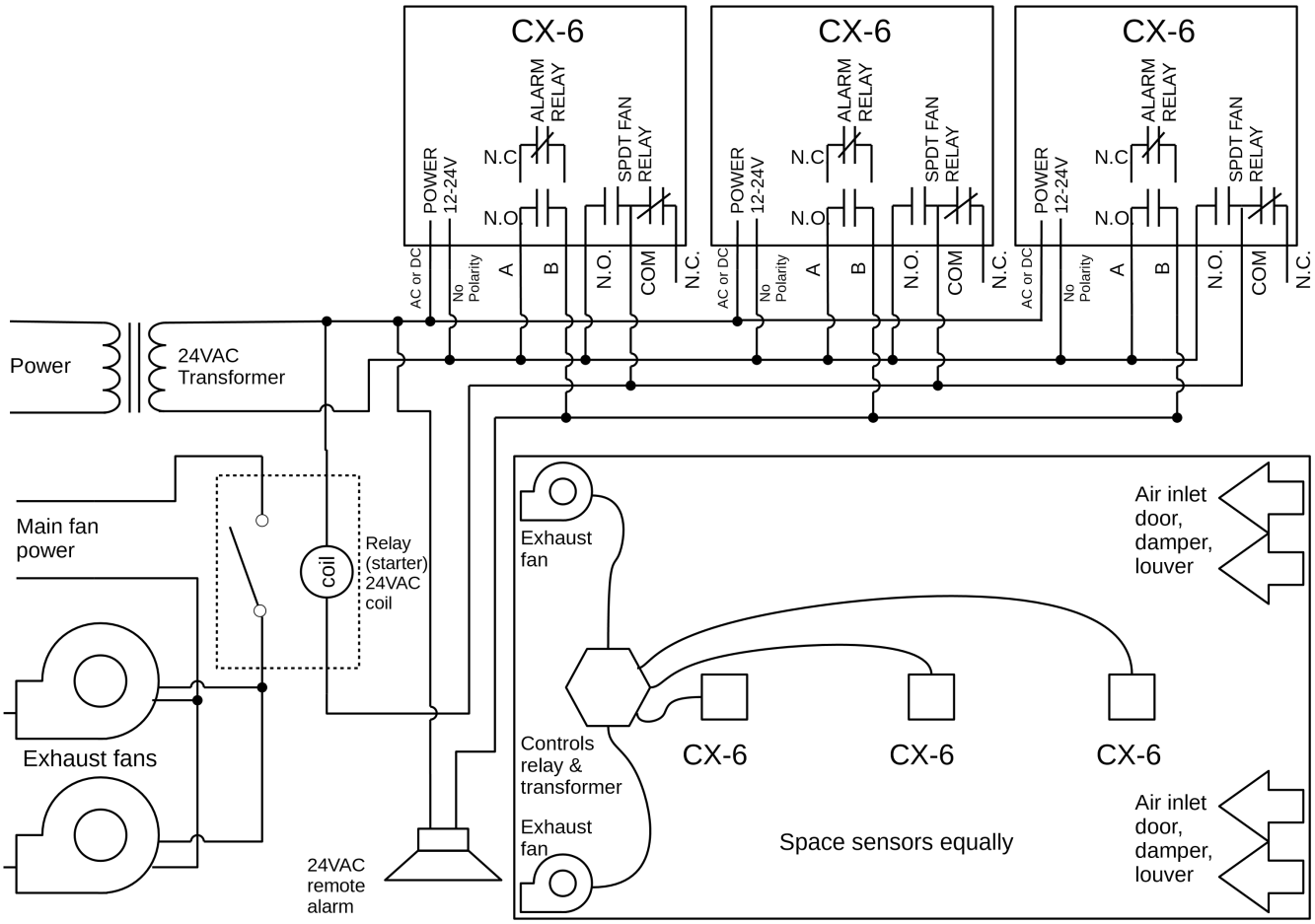

Figure 3–5 6-Series Multiple Devices

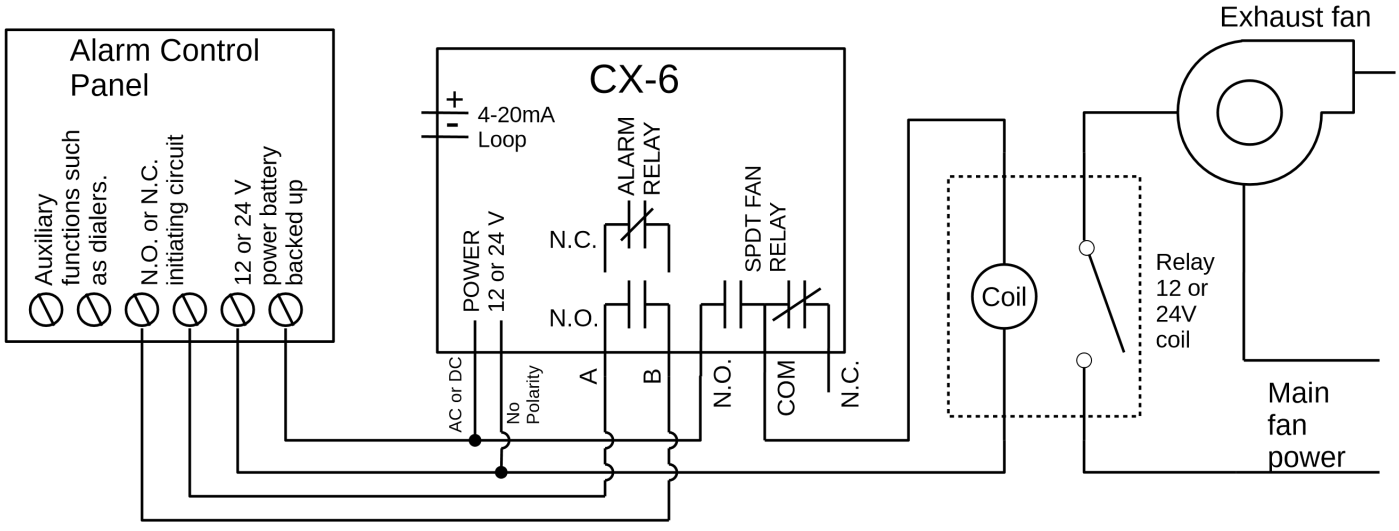

Figure 3–6 6-Series Alarm Control Panel

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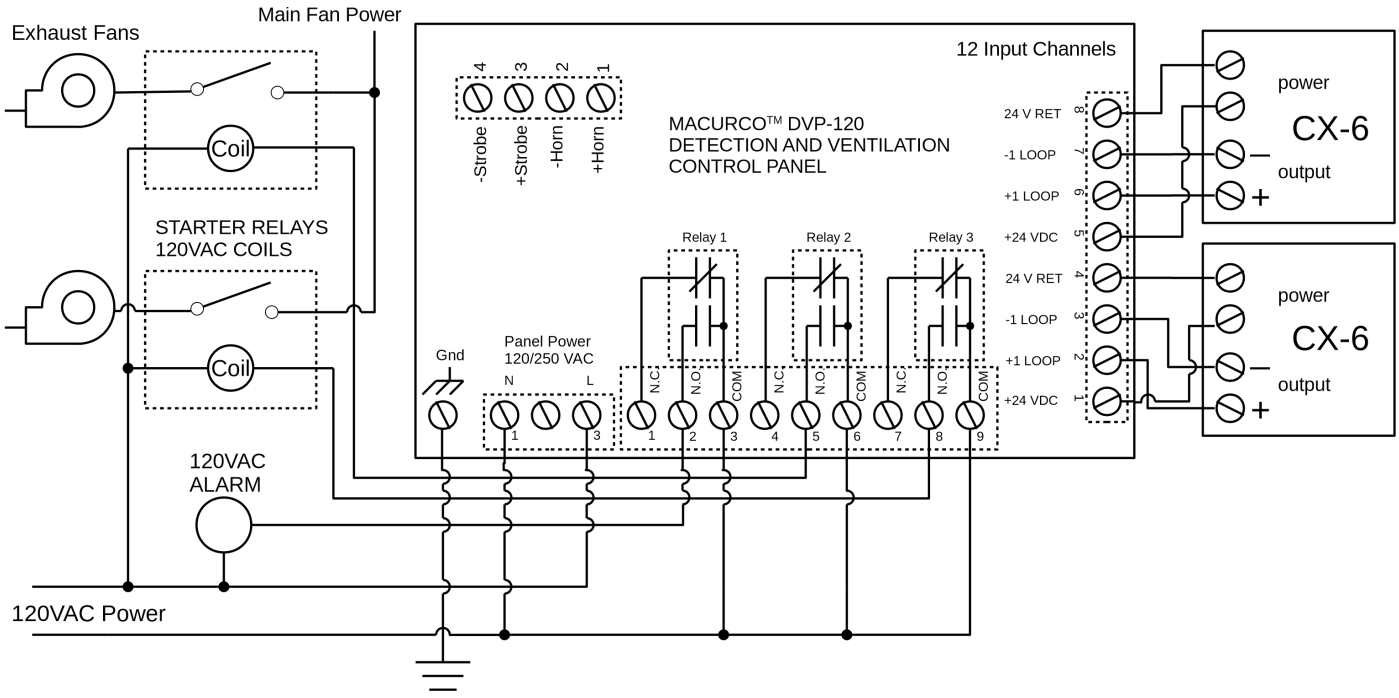

Figure 3–7 6-Series DVP-120 Control Panel

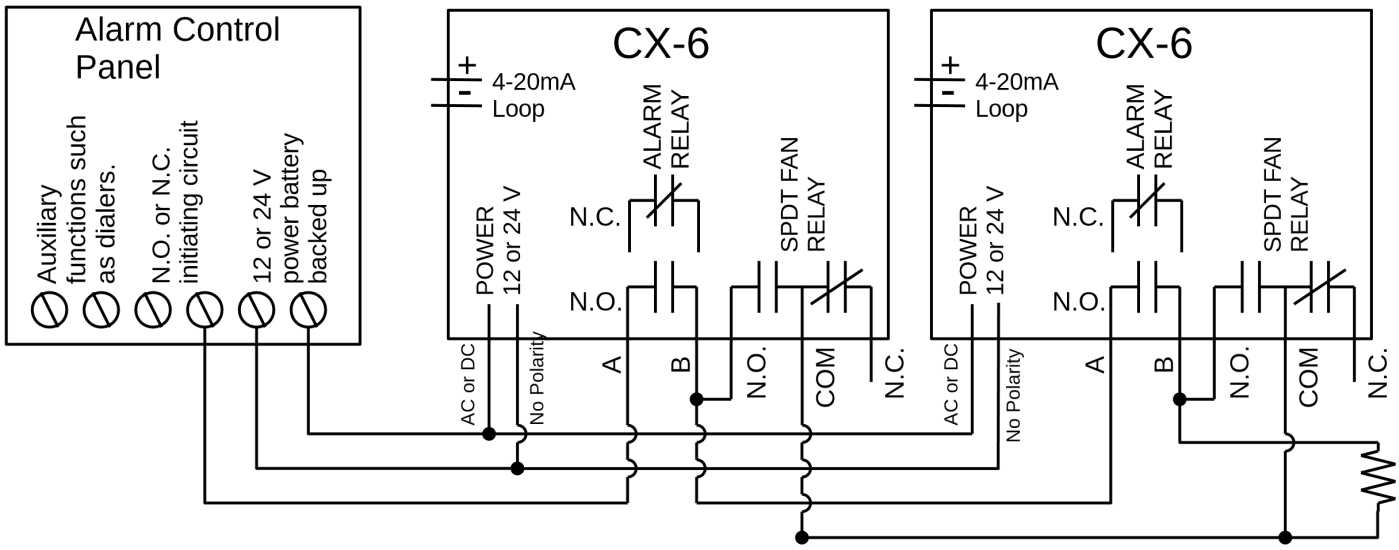

Figure 3–8 6-Series Alternate Alarm Panel

In this application (above) the Fan or primary relay is used as a low-level alarm relay. The Alarm or secondary relay is used as a supervisory relay when utilized in the normally closed configuration. The CX-6 monitors all critical functions of the unit through software diagnostics that continually test and verify its operations. If a problem is found, the unit will switch to a fail-safe/error mode or trouble condition. In this error mode the Fan* and Alarm relays will be activated indicating the trouble condition at panel and the CX-6 display will flash the error.

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*See section 4.5.11 Select Trouble Fan Setting – “tFS” for options.

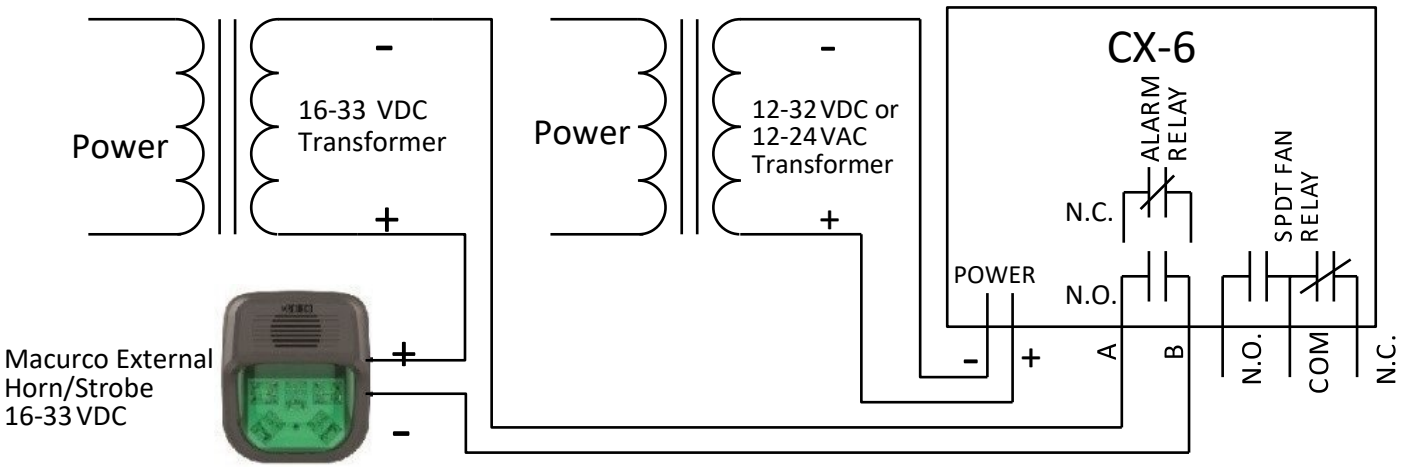

Figure 3–9 6-Series Horn & Strobe Combo Wiring

Macurco External Horn/Strobe model number is HS-X, where X represents lens color, R for red lens cover, G for green lens cover, B for blue lens cover, A for amber lens cover, C for clear lens cover. Sound pressure for Horn/Strobe model is at least 85dB at 10 feet.

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3.2.2 12-Series Line Voltage

1. The CX-12 mounts on a 4" square (or 4x4) electrical box supplied by the contractor. Do not mount the CX-12 inside another box, unless it has good air flow through it.
2. There are two terminals for the mains power connection labeled L (line) and N (neutral). Mains connections should be done in accordance with National and Local Electrical Codes. Only qualified personnel should connect mains power to any device.
3. There are two terminals for the dry alarm relay contacts with no polarity preference. The alarm relay can switch up to 0.5 A 120 V, or 60 VA. The alarm relay is activated if gas reaches or exceeds the alarm settings. See section 4.5 Configuration "CON" for details on relay settings.
4. The alarm relay can be configured to normally open (default) (N.O.) or normally closed (N.C.) and will activate:
    a. if either the CO or NO_2 gas concentration exceeds the alarm set point. It will deactivate once the gas concentration drops below the alarm set point. Note that setting both "ArS.C" and "ArS.n" to "diS" will cause the alarm relay not to engage.
    b. during a power up test "PUt".
    c. when a trouble condition is present.
5. The dry contact, SPDT fan relay has three terminals. The common (COM.), normally open (N.O.) and the normally closed (N.C.) contact. The fan relay can switch up to 5.0 A up to 240 VAC. See section 4.5 Configuration "CON" for details on relay settings.
6. The Fan Relay can be configured for latching or non-latching (default) when activated (when the gas concentration exceeds fan relay set point). Once latched in, power will need to be interrupted or the "TEST" button pressed to un-latch the relay condition.
7. The Fan Relay will engage if the fan setting Carbon Monoxide or Nitrogen Dioxide concentration is exceeded for longer than the Fan Relay Delay time. Unless it is configured for latching, the fan relay will disengage once both of these conditions have been met:
    - Carbon Monoxide and Nitrogen Dioxide concentrations have dropped below fan setting
    - Fan Relay Run time has been exceeded

    Note that the "disable" fan setting will cause the fan relay to not engage. The fan relay will engage in trouble fault condition (if the Trouble Fan Setting Option is set to "ON") and will disengage once trouble fault condition is cleared.
8. The Current Loop is 4 mA in clean air and 4-20 mA for 0-200ppm CO and 4-20 mA for 0-20ppm NO_2. There are two terminals and polarity is marked on the connector.

NOTE: 22 to 12 AWG wire shall be used. Wire used shall meet the temperature range of the detector i.e. 0°F to 125° F (-18°C to 52°C).

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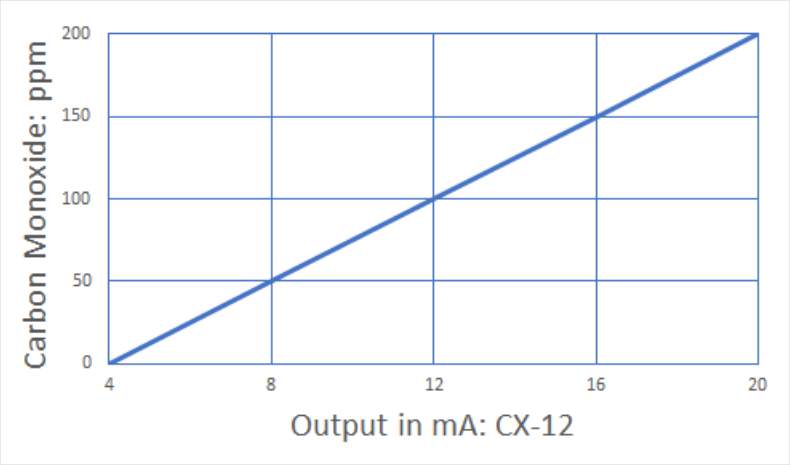

Figure 3–10 12-Series 4-20 mA CO Output diagram

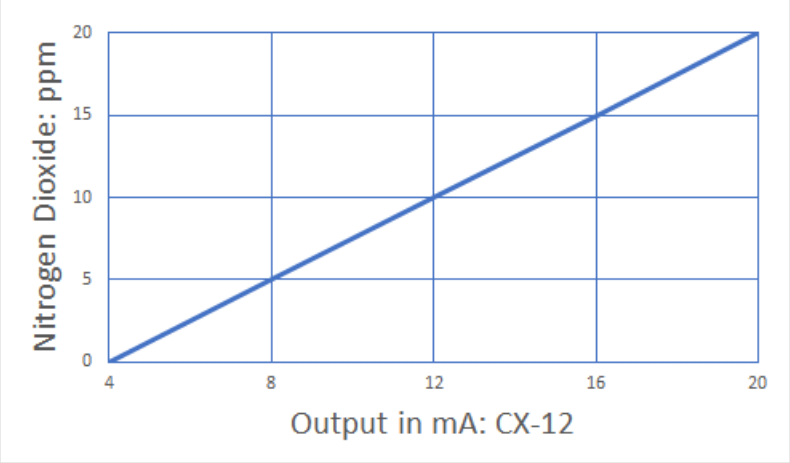

Figure 3–11 12-Series 4-20 mA NO2 Output diagram

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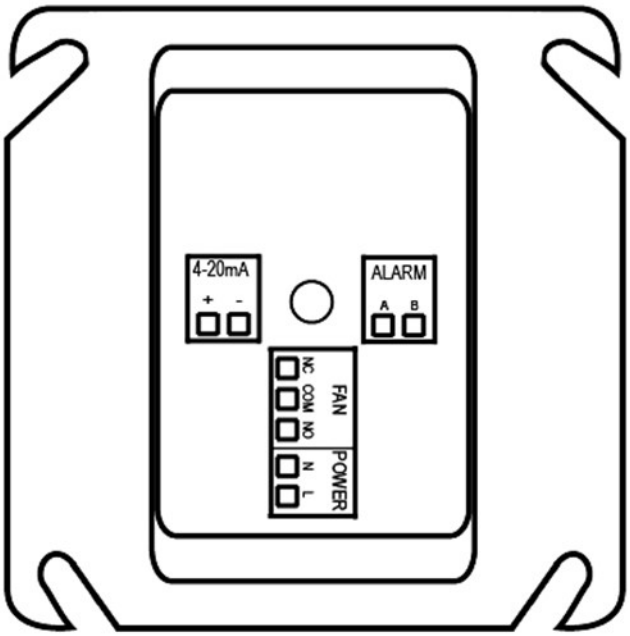

Figure 3–12 12-Series Rear View

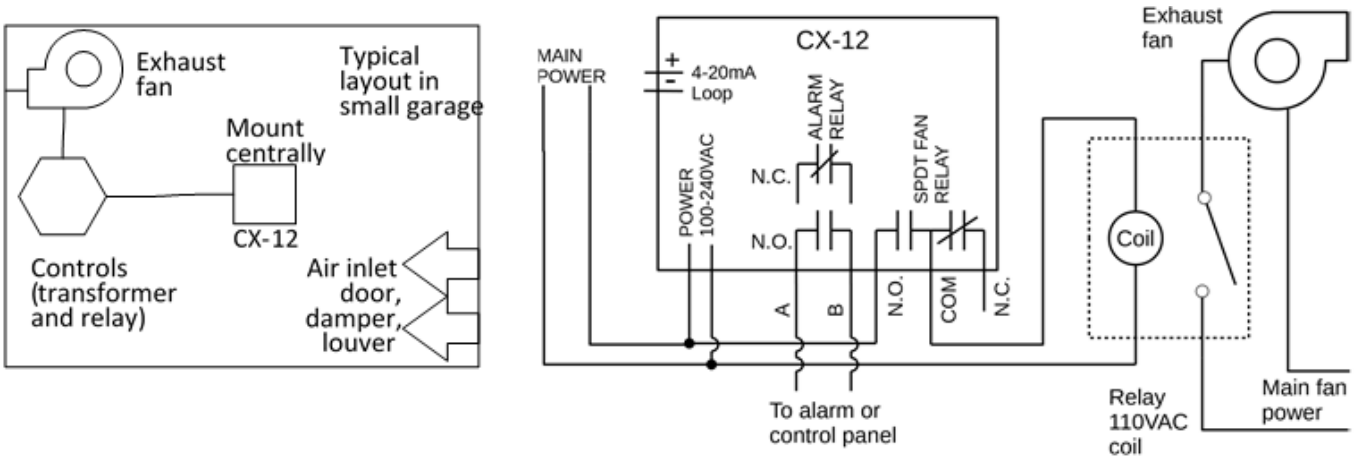

Figure 3–13 12-Series Typical Installation

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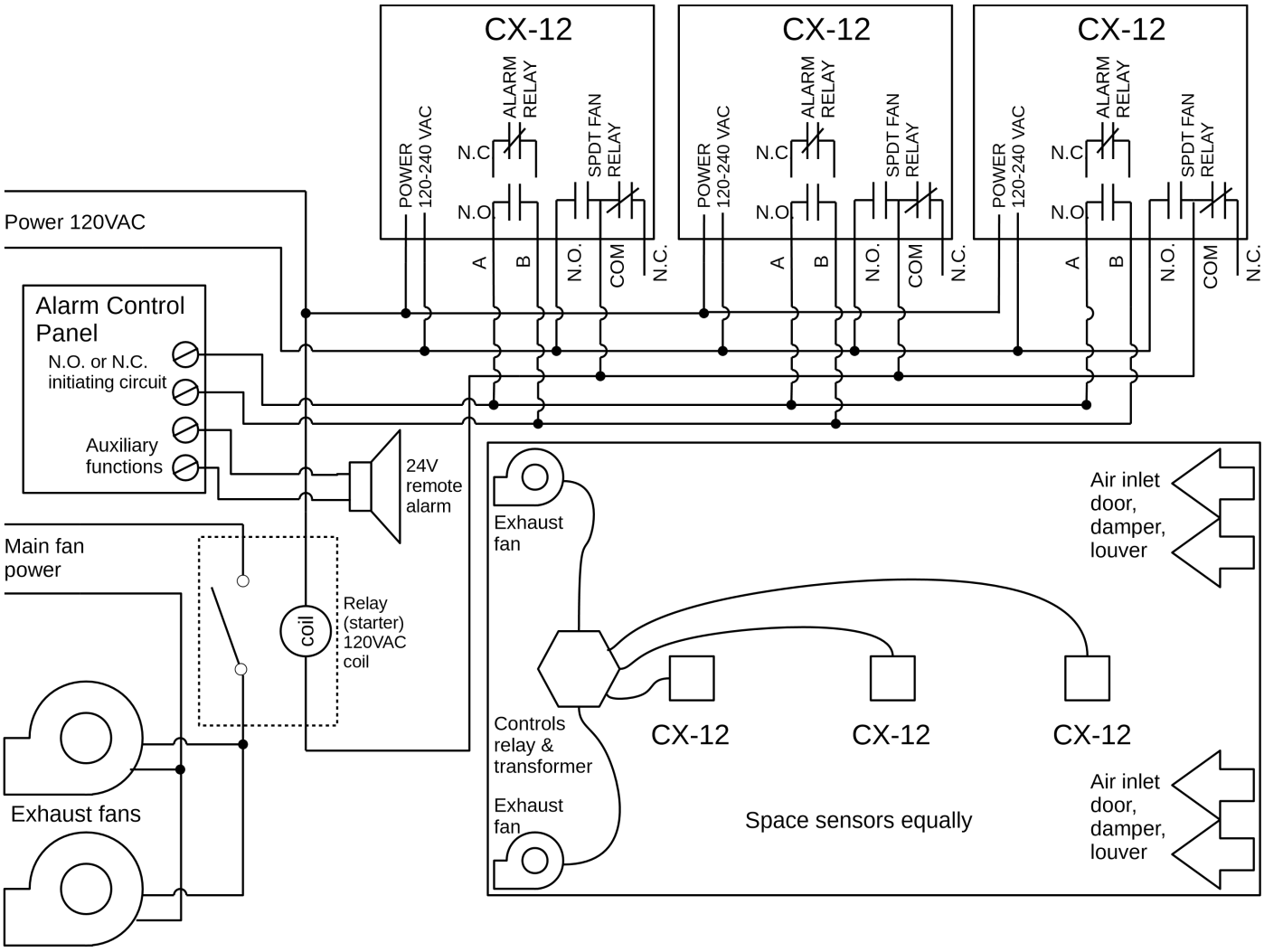

Figure 3–14 12-Series Multiple Device diagram

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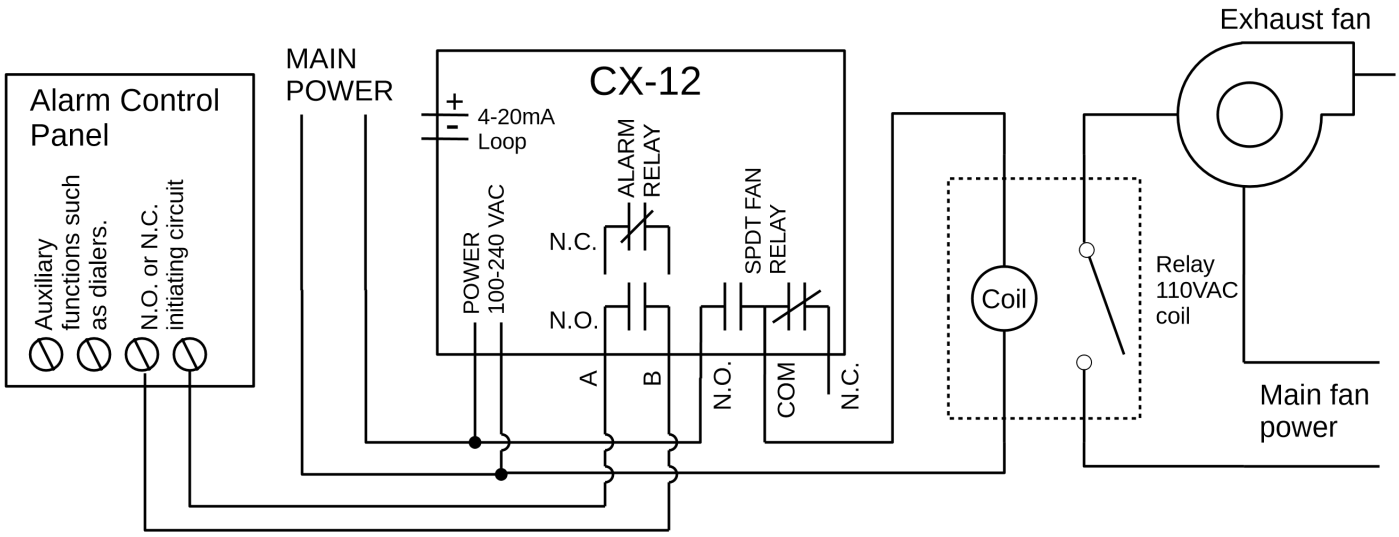

Figure 3–15 12-Series Alarm Control Panel

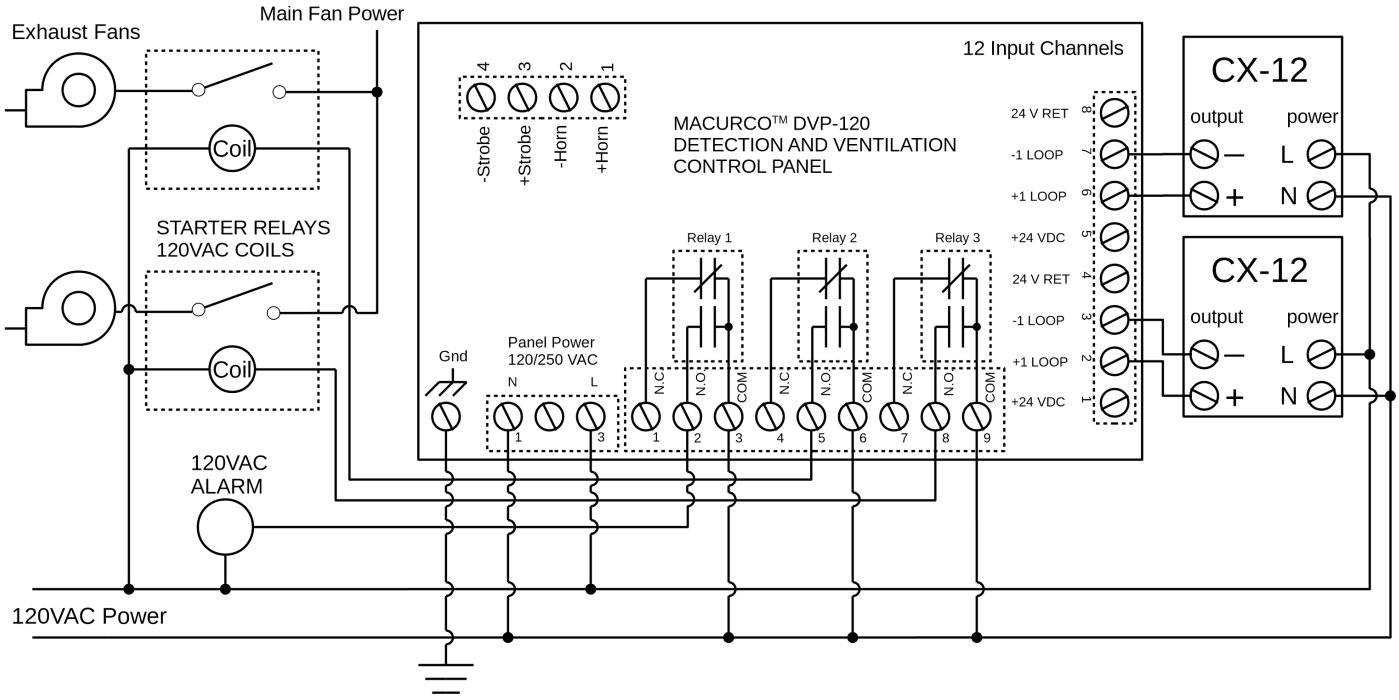

Figure 3–16 12-Series DVP-120 Control Panel

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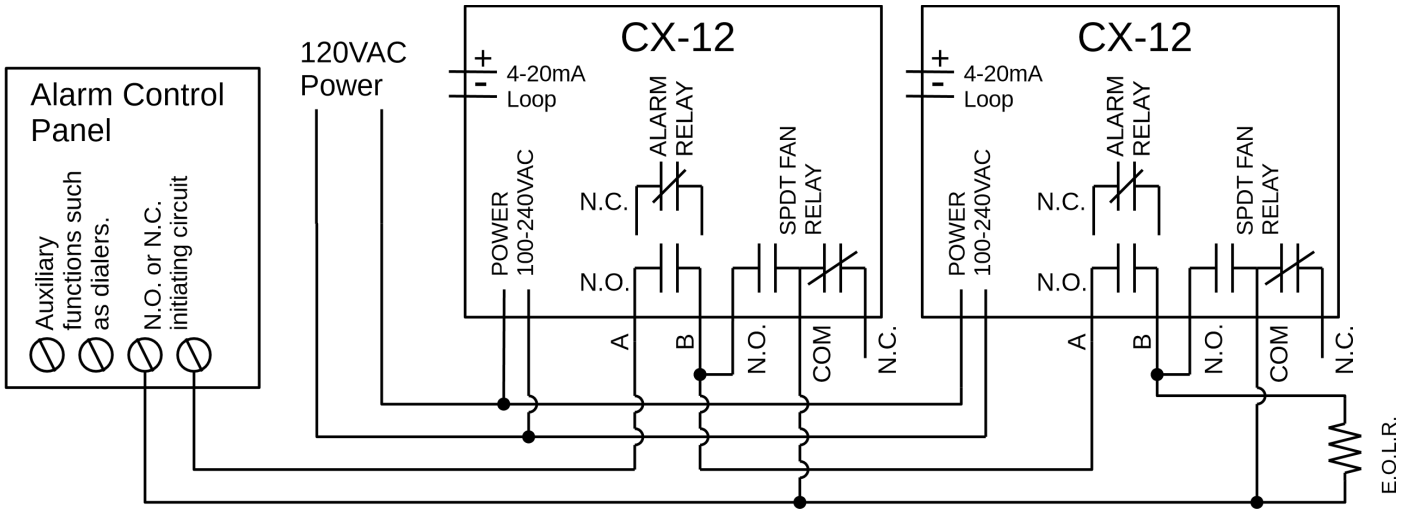

Figure 3–17 12-Series Alternate Alarm Panel

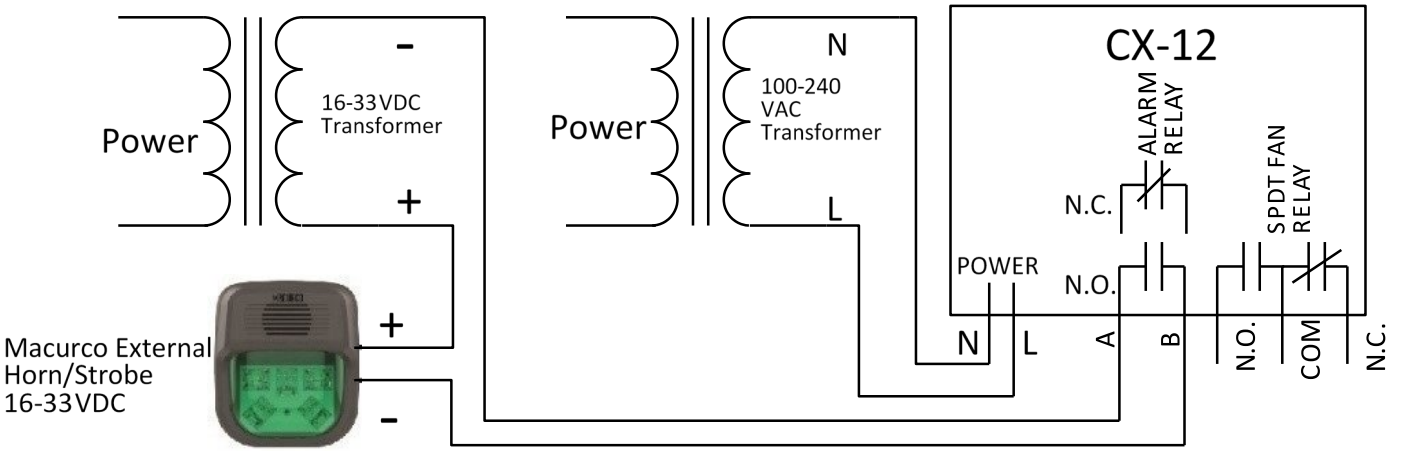

Figure 3–18 12-Series Horn & Strobe Combo Wiring

Macurco External Horn/Strobe model number is HS-X, where X represents lens color, R for red lens cover, G for green lens cover, B for blue lens cover, A for amber lens cover, C for clear lens cover. Sound pressure for Horn/Strobe model is at least 85dB at 10 feet.

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3.3 Terminal Connection

3.3.1 6-Series Low Voltage

Except for the safety ground, all field wiring is completed via modular connectors (provided). After wiring, simply plug the modular connectors into the matching connectors on the back side of the detector.

NOTE: 22 to 12 AWG wire shall be used. Wire used shall meet the temperature range of the detector i.e. 0°F to 125° F (-18°C to 52°C).

3.3.1.1 Mains Power Connection

Connect the CX-6 to Class 2 listed power supply only. It is suggested to use a separate transformer for powering the unit or units because of possible interferences from other devices on the same power supply. Connect the CX-6 to the control cables with terminal plugs. When making connections, make sure the power is off. There are two terminals for Power: 12 to 24 VAC or 12 to 32 VDC, with no polarity preference

Ensure that the wire cannot be easily pulled from the connector. Plug the modular connection into the Fan/Power connection and ensure that it latches into the header properly.

3.3.1.2 Fan Relay Connection

All of the SPDT Fan relay terminals are available at the Fan/Power modular connector. Each Fan relay terminal normally open, common and normally closed (NO, COM and NC) can accommodate a wire size 12 to 22 AWG. To install the wiring for the relays, disconnect the connector from the header. Strip the insulation of each wire back approximately 1/4 in. (6.5 mm), insert the bare wire into the terminal and tighten the screw clamp. Ensure that the wire cannot easily be pulled from the connector. Plug the modular connection into the Fan/Power connection and ensure that it latches into the header properly.

3.3.1.3 Alarm Relay Connection

The external alarm connections (A and B) are available at the Alarm modular connector. There is no polarity for these connections. To install the wiring for the alarm contacts, disconnect the connector from the header on the detector. Strip the insulation of each wire back approximately 1/4 in. (6.5 mm), insert the bare wire into the terminal and tighten the screw clamp. Ensure that the wire cannot easily be pulled from the connector. When the wires are connected, seat the modular connector into the header ensuring that the latch engages.

3.3.1.4 4-20 mA Signal Connection

The positive and negative 4-20mA signal connections (+ and -) are available at the 4-20mA modular connector, a 2-position connector. To install the wiring for the 4-20 mA contacts, disconnect the connector from the header on the detector. Strip the insulation of each wire back approximately 1/4 in. (6.5 mm), insert the bare wire into the terminal and tighten the screw clamp. Ensure that the wire cannot easily be pulled from the connector. When the wires are connected, seat the modular connector into the header ensuring that the latch engages.

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3.3.2 12-Series Line Voltage

With the exception of the safety ground, all field wiring is completed via modular connectors (provided). After wiring, simply plug the modular connectors into the matching connectors on the back side of the detector.

NOTE: 22 to 12 AWG wire shall be used. Wire used shall meet the temperature range of the detector i.e. 0°F to 125° F (-18°C to 52°C).

3.3.2.1 Power Connection

Mains connections should be done in accordance with National and Local Electrical Codes. Only qualified personnel should connect Mains power to any device. Macurco recommends a minimum wire size of AWG18 and the wire insulator must be rated for 140°F (60°C) service. The modular connector will accept wire from 12 to 22 AWG.

The safety ground wire should be secured to the ground screw of the metal electrical box. Tighten the screw and make sure the wire is snug. Ensure that the wire cannot be pulled out from under the screw.

The Line (L) and Neutral (N) wires should be stripped 1/4 in. (6.5 mm), insert the wire into the ”L” and “N” wire positions of the modular Fan/Power connector and tighten the screw clamp. Ensure that the wire cannot be easily pulled from the connector. Plug the modular connection into the Fan/Power connection and ensure that it latches into the header properly.

3.3.2.2 Fan Relay connection

All of the SPDT Fan relay terminals are available at the Fan/Power modular connector. Each Fan relay terminal normally open, common and normally closed (NO, COM and NC) can accommodate a wire size 12 to 22 AWG. To install the wiring for the relays, disconnect the connector from the header. Strip the insulation of each wire back approximately 1/4 in. (6.5 mm), insert the bare wire into the terminal and tighten the screw clamp. Ensure that the wire cannot easily be pulled from the connector. Plug the modular connection into the Fan/Power connection and ensure that it latches into the header properly.

3.3.2.3 Alarm Relay Connection

The external alarm connections (A and B) are available at the Alarm modular connector. There is no polarity for these connections. To install the wiring for the alarm contacts, disconnect the connector from the header on the detector. Strip the insulation of each wire back approximately 1/4 in. (6.5 mm), insert the bare wire into the terminal and tighten the screw clamp. Ensure that the wire cannot easily be pulled from the connector. When the wires are connected, seat the modular connector into the header ensuring that the latch engages.

3.3.2.4 4-20 mA Signal connection

The positive and negative 4-20mA signal connections (+ and -) are available at the 4-20mA modular connector, a 2-position connector. To install the wiring for the 4-20 mA contacts, disconnect the connector from the header on the detector. Strip the insulation of each wire back approximately 1/4 in. (6.5 mm), insert the bare wire into the terminal and tighten the screw clamp. Ensure that the wire cannot easily be pulled from the connector. When the wires are connected, seat the modular connector into the header ensuring that the latch engages.

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4 Operations

4.1 Power up

The CX-xx cycles through an internal self-test cycle for the first minute that it is powered. The unit will execute the test cycle any time power is dropped and reapplied (i.e. power failure).

During the self-test cycle the unit will:

- Display the firmware version number, then count down from 60 to 0 (if the display setting is “On”).
- The alarm relay will be activated for 10 seconds and the fan relay for 60 seconds during the power-up cycle (if PUt is ON).
- The indicator light (LED) will flash green during the self-test cycle.
- 4-20mA will ramp up to 16mA during the warmup (if 420 is ON and PUt is ON).
- At the end of the 1-minute cycle, the unit will take its first sample of the air and the indicator light will turn solid green.

4.2 Display turned “On”

With the display (“dSP”) setting turned “On”, the detector will operate as follows:

Clean Air – The CX-xx will flash between the current concentration of CO ppm and the current concentration of NO_2 ppm. The CO reading will start with a “C” and the NO_2 reading will start with an “n”.

Fan Relay Level – When either the CO or NO_2 concentration reaches the Fan Relay setting and the Fan Run Delay “Frd” period has elapsed, the display will flash between “FAn” and the current concentration of gases. The sequence of display when the Fan Relay is activated is: “Fan”, CO (“CXXX”) reading, NO_2 reading (“n Y.Y”).

Alarm Relay Level – When either the CO or NO_2 concentration reaches the Alarm Relay setting, the display will flash between “ALr” and the current concentration of gases. The sequence of display when the Alarm Relay is activated is: “ALr”, CO Reading (“CXXX”), NO_2 reading (“n Y.Y”).The buzzer will sound indicating “Alarm” if the buzzer is turned “On”.

Trouble – When the device is in a trouble state, the display will display the “t” Error code (t001 for example) and the Alarm Relay will activate. If the Trouble Fan Setting is enabled, the Fan Relay will activate. See Section 5.1.2 “t” Error Codes and Section 4.5.11 Select Trouble Fan Setting – “tFS”

NOTE: Trouble states related to the CO and NO_2 sensors are represented by different “t” Error codes. So, if an error exists for the CO or NO_2 sensor only, the display will alternate between the trouble code for the sensor in the trouble state and the gas reading for the sensor in the normal state.

Calibration Due – When the Calibration Period functionality is enabled and the detector is within 1 month of the calibration period, the Calibration Due message will be displayed. Calibration Due is indicated by “CdUE” (for CO Sensor) and “ndUE” (for NO_2 sensor). When both CO and NO_2 sensors are in Calibration Due, the display sequence will be “CdUE”, CO reading, “ndUE”, NO_2 reading.

Calibration Due is resolved only with a successful field calibration.

NOTE: If a Fan or Alarm Relay is activated during Calibration Due, ‘Fan’ or ‘ALr’ will be appended at the end of the display sequence for calibration due.

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4.3 Display turned "Off"

With the display ("dSP") setting turned "OFF", the detector will operate as follows:

Clean Air –The display does not show the CO or NO_2 concentration. Only the Power indicator light on will be on.

Fan Relay Level – When the CO or NO_2 concentration reaches the Fan Relay setting and the Fan Run Delay "Frd" period has elapsed, the display will continuously show "FAn".

Alarm Relay Level – The display does not show the CO or NO_2 concentration but will show "ALr" when the Alarm relay is activated. The buzzer will sound indicating "Alarm" if the buzzer is turned "On".

Trouble –When the device is in a trouble state, the display will display the "t" Error code (t001 for example) and the Alarm Relay will activate. If the Trouble Fan Setting is enabled, the Fan relay will switch activating the relay. See Section 5.1.2 "t" Error Codes and Section 4.5.11 Select Trouble Fan Setting – "tFS".

Calibration Due – When the Calibration Period functionality is enabled and the detector is within 1 month of the calibration period, the Calibration Due message will be displayed. Calibration Due is indicated by "CdUE" (for CO Sensor) and "ndUE" (for NO_2 sensor). When both CO and NO_2 sensor are in Calibration Due, the display sequence will be "CdUE", "ndUE".

Calibration Due is resolved only with a successful field calibration.

NOTE: If a Fan or Alarm Relay is activated during Calibration Due, 'Fan' or 'ALr' will be appended at the end of the display sequence.

4.4 4-20mA Loop

In High Mode "HigH", the output will correspond to the higher output of the two sensors. For example, a CO reading of 50ppm corresponds to an output of 8mA and a NO_2 reading of 10ppm corresponds to an output of 12mA. The output in High Mode will be 12mA.

NOTE: High Mode should only be used when the detector is used as a standalone unit. Dual Mode **must** be used when the detector is connected to a Macurco DVP control panel.

In Dual Mode "dUAL", the current fluctuates between different values when measured using an ammeter. It will represent the CO and NO_2 readings simultaneously by using a signal that is readable by a Macurco DVP panel.

Clean Air – With the 4-20 mA function turned "On" in "HigH" mode, and the current concentration of gases at "0" (zero), the 4-20mA loop will output 4 mA.

Gas read – With the 4-20 mA function turned "On" in "HigH" mode, the output will read between 4 mA and 20 mA depending on the current concentration of gases.

Trouble – With the 4-20 mA function turned "On" in "HigH" mode and the Trouble Fan Setting enabled, the 4-20 mA loop will output 1 mA or 24 mA depending on the Trouble condition. See Section 5.1 On-Board Diagnostics.

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4.5 Configuration "CON"

To change the settings, remove the Philips screw on the front of the CX-xx. Pull off the front cover of the unit. Locate the MENU and ENTER buttons on the top left of the board.

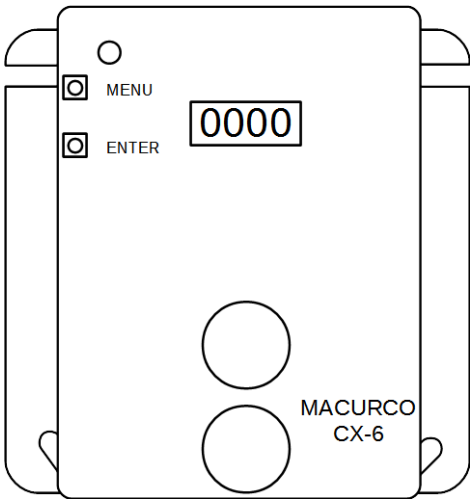

Figure 4–1 - Board View

4.5.1 Default – Factory Settings

The CX-xx comes pre-programed with the following default settings:

Setting Description	Display	Default Setting
Power Up Test	PUt	On
Display	dSP	On
Buzzer	bUZ	On
CO Alarm Relay Setting	ArS.C	200
NO_2 Alarm Relay Setting	ArS.n	5
Alarm Relay Configuration	Arc	nO
CO Fan Relay Setting	FrS.C	35
NO_2 Fan Relay Setting	FrS.n	2.5
Fan Relay Delay	Frd	3
Fan Relay Minimum Runtime	Frr	0
Fan Relay Latching	FrL	OFF
Trouble Fan Setting	tFS	OFF
4-20 mA	420	bAS
4-20 mA mode	420.n	dUAL
CO Calibration Period	CAL.C	diS
NO_2 Calibration Period	CAL.n	diS

To reset the device to factory settings, see section 4.5.2 Select Default Configuration – "dEF".

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4.5.2 Select Default Configuration – “dEF”

Available options are “YES”, “nO”.

NOTE: This menu cannot be changed when the CX-xx is in calibration due or calibration overdue. (Refer to Calibration Period – “CAL” for information on calibration due and calibration overdue.)

To select the Default Configuration (this will reset the device to its default settings), in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. The first selection is the “dEF” or Default setting. Push **Enter**.
4. If it is already in Default configuration, “YES” will be displayed and there will be no available action. If it is not already in Default configuration, “nO” will be displayed.
5. Push **Next** to change it to “YES” (display will begin flashing).
6. Push **Enter** to confirm resetting the device to its default settings (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

4.5.3 Select Power-Up Test Setting – “PUt”

Available options are “On” (default), “OFF”.

To select the Power Up Test Configuration, in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 1 time to get to “PUt” or Power Up Test Configuration.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

4.5.4 Select Display Configuration – “dSP”

Available options are “On” (default), “OFF”.

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To select the Display Configuration, in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 2 times to get to “dSP” or Display Configuration.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

4.5.5 Select Buzzer Configuration – “bUZ”

Available options are “On” (default), “OFF”.

To select the Buzzer Configuration, in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 3 times to get to “bUZ” or Buzzer setting.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

4.5.6 Select Alarm Relay Setting for CO – “ArS.C”

Available options are “diS”, 50, 100, 150, 200 (default).

To select the Alarm Relay Setting for CO, in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 4 times to get to “ArS.C” or Alarm Relay Setting for CO.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

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4.5.7 Select Alarm Relay Setting for NO2 – "ArS.n"

Available options are "diS", 1.0, 2.0, 3.0, 4.0, 5.0 (default), 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 180.0, 19.0, 20.0.

To select the Alarm Relay Setting for NO_2, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 5 times to get to "ArS.C" or Alarm Relay Setting for NO_2.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

4.5.8 Select Alarm Relay Configuration – "Arc"

Available options are "nO" (default), "nC".

To select the Alarm Relay Configuration, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 6 times to get to "Arc" or Alarm Relay Configuration.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

4.5.9 Select Fan Relay Setting for CO – "FrS.C"

Available options are "diS", 15, 25, 35 (default), 50, 100.

To select the Fan Relay Setting for CO, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 7 times to get to "FrS.C" or Fan Relay Setting for CO.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

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4.5.10 Select Fan Relay Setting for NO2 – "FrS.n"

Available options are "diS", 0.5, 0.7, 1.0, 1.2, 1.5, 1.7, 2.0, 2.2, 2.5 (default), 2.7, 3.0, 3.2, 3.5, 3.7, 4.0, 4.2, 4.5, 4.7, 5.0.

To select the Fan Relay Setting for NO2, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 8 times to get to "FrS.n" or Fan Relay Setting for NO2.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

4.5.11 Select Fan Relay Delay Setting – "Frd"

Available options are 0, 1, 3 (default), 5, 10.

To select the Fan Relay Delay Setting, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 9 times to get to "Frd" or Fan Relay Delay Setting.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

4.5.12 Select Fan Relay Minimum Runtime Setting – "Frr"

Available options are 0 (default), 3, 5, 10, 15.

To select the Fan Relay Minimum Runtime Setting, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 10 times to get to "Frr" or Fan Relay Minimum Runtime Setting.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

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4.5.13 Select Fan Relay Latching Setting – "FrL"

Available options are "On", "OFF" (default).

To select the Fan Relay Latching Setting, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 11 times to get to "FrL" or Fan Relay Latching Setting.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

4.5.14 Select Trouble Fan Setting – "tFS"

Available options are "On", "OFF" (default).

To select the Trouble Fan Setting, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 12 times to get to "tFS" or Trouble Fan Setting.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

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4.5.15 Select 4-20mA Output Setting – “420”

Available options are “bAS” (default), “EnH”, “OFF”.

NOTE: If the calibration period feature is used and the detector is connected to a panel, the calibration period information is communicated to the Macurco DVP panel only when “420” is set to “EnH”. Please refer to the Macurco DVP Panel to confirm if the calibration period feature is supported by the panel. If calibration period feature is not supported by Macurco DVP panel, ‘bAS’ must be the selected output setting.

To select the 4-20mA Output Setting, in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 13 times to get to “420” or 4-20mA Output Setting.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

4.5.16 Select 4-20mA Mode – “420.n”

Available options are “dUAL” (default), “HigH”.

NOTE: Dual Mode must be used when the detector is connected to a Macurco DVP control panel. High Mode should only be used when the detector is used as a standalone unit.

To select the 4-20mA Mode, in normal mode:

1. Push the **Next** button to get to “Con” or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 14 times to get to “420.n” or 4-20mA Mode.
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until “End” is displayed.
9. Push **Enter** to return to normal operation.

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4.5.17 Select Calibration Period for CO Sensor – "CAL.C"

The value selected for Calibration Period is the number of months. The CX-xx indicates a "calibration due" when it is within 1 month of the calibration period, and a "calibration overdue" when the detector has reached or exceeded the calibration period. The Calibration Period setting cannot be changed if the CX-xx is indicating "calibration due" or "calibration overdue".

Available options are "diS" (default), 3, 6, 12, 24.

To select the Calibration Period for the CO sensor, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 15 times to get to "CAL.C".
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

4.5.18 Select Calibration Period for NO_2 Sensor – "CAL.n"

The value selected for Calibration Period is the number of months. The CX-xx indicates a "calibration due" when it is within 1 month of the calibration period, and a "calibration overdue" when the detector has reached or exceeded the calibration period. The Calibration Period setting cannot be changed if the CX-xx is indicating "calibration due" or "calibration overdue".

Available options are "diS" (default), 3, 6, 12, 24.

To select the Calibration Period for the NO_2 sensor, in normal mode:

1. Push the **Next** button to get to "Con" or the Configuration menu.
2. Push the **Enter** button to enter the Con menu.
3. Push **Next** 16 times to get to "CAL.n".
4. Push **Enter**. The display will show the current setting.
5. Push **Next** to cycle through the available settings (display will begin flashing).
6. Push **Enter** to confirm the new setting (display will stop flashing).
7. Push **Enter** once more to return to the configuration menu.
8. Push **Next** until "End" is displayed.
9. Push **Enter** to return to normal operation.

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5 Troubleshooting

5.1 On-Board Diagnostics

The CX-xx monitors all critical functions of the unit through software diagnostics that continuously test and verify unit operations. If a problem is found, the unit will switch to a fail-safe/error mode or trouble condition.

In this error mode, the Alarm relay will be activated, the 4-20 mA current loop will go to 24 mA, the unit will display the error code, the green status indicator LED light will flash, and the buzzer will chirp intermittently. The Fan relay will also engage if the Trouble Fan Setting Option is set to "On". This is a safety precaution.

To clear this mode, simply turn off power to the unit for a few seconds or push the ENTER/TEST button (inside the unit). This will cause the unit to restart the 1-minute self-test cycle.

5.1.1 4-20mA troubleshooting

NOTE: The output from the 4-20ma terminals is steady only when the 4-20mA mode is set to high mode. In dual mode, fluctuating output will be observed when measured using an ammeter.

- 0 mA is most likely a connection problem
- 1 mA indicates Calibration Overdue (if 4-20mA is configured to 'EnH')
- 4-20 mA is normal gas reading range (0-200 ppm CO, 0-20 ppm NO_2)
- 24 mA indicates a Trouble condition

5.1.2 Trouble Codes

If the detector encounters an error, a trouble code is displayed. The trouble code is displayed as "tXXX" where XXX is a unique trouble code for each sensor. If a trouble code is larger than 800, it is for CO. If it is smaller than 800, it is for NO_2. The following table shows the trouble codes for the CO and NO_2 sensors.

CO Trouble Code	NO_2 Trouble Code	Description
t801	t001	Sensor Missing
t802	t002	Temperature Compensation Failed
t804	t004	Bad EEPROM Checksum
t810	t010	Bad EEPROM
t820	t020	Bad Calibration
t840	t040	Never Factory Calibrated
t880	t080	Read ADC Failed
t900	t100	Sensor Under Range
tA00	t200	Sensor Expired
tc00	t400	Calibration Overdue

Figure 5-1 – Trouble Code Table

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When trouble codes exist for both sensors at the same time, the two trouble codes will be displayed alternately.

If there are multiple error codes for the same sensor existing at the same time, the displayed code will be the sum of error codes. E.g. The display will show “t003” if t001 and t002 exist at same time, “t821” if t820 and t801 exist at the same time.

If the sum for a digit (ones, tens or hundreds) is greater than 9, it will display the corresponding hexadecimal representation of the sum. The following table shows the hexadecimal representation for numbers from 10 to 15.

Decimal Number	Hexadecimal Representation
10	A
11	b
12	c
13	d
14	E
15	F

Figure 5-2 - Hexadecimal Conversion Table

For example, if t040 and t080 exists at the same time then it displays “t0c0” because 8 + 4 equals 12 and the hexadecimal representation of 12 is “c”.

Note that in tXXX first digit after ‘t’ is 8 for CO sensor and 0 for NO2 sensor. Trouble codes t900, tA00 and tc00 are result of adding 1, 2 and 4 to first digit 8 used to represent CO sensor. Hence when adding up the trouble code for the CO sensor, 8 is not added twice. E.g. if t820 and t810 exist at same time displayed error code will be t830. Similarly, if tA00 and tc00 exist at the same time, then the trouble code displayed is tE00.

NOTE: If the error mode repeats frequently, check for continuous power and proper voltage. If power is not the problem and a unit has repeating error conditions, it may need to be returned to Macurco for service, per these User Instructions. If the error mode indicates “Sensor expired”, see section 6.1 Sensor Life Reset.

5.2 Sensor Poisons

The sensors in the detector are designed with extreme sensitivity to the environment. As a result, the sensing function may be deteriorated if the detector is exposed to contaminants, a direct spray from aerosols such as paints, silicone vapors, etc., or to a high density of corrosive gases (such as hydrogen sulfide, sulfur dioxide) for an extended period.

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5.3 Sensor Expired

The CX-xx has two replaceable electrochemical sensors (one CO and one NO_2). Each sensor has an expected life of two years. After two years, the “Sensor expired” signal will be activated indicating that one or both sensors have reached the end of their typical usable life. The “Sensor expired” signal will cause an error code (tA00 for CO, t200 for NO_2). See Section 5.1.2 Trouble Codes.

The “Sensor expired” signal can be silenced for 48 hours by pressing the "ENTER/TEST" button or by temporarily dropping power to the unit. The “Sensor expired” signal provides the user an opportunity to test and/or calibrate the sensor assuring that it is still performing within acceptable parameters though the sensor is nearing the end of its expected life.

The silence function will continue to be available for 29 days after the CX-xx initiates the initial “Sensor expired” signal. After this 29-day period the CX-xx can no longer be silenced, and the sensor must be calibrated, and the sensor life reset, or the sensor replaced.

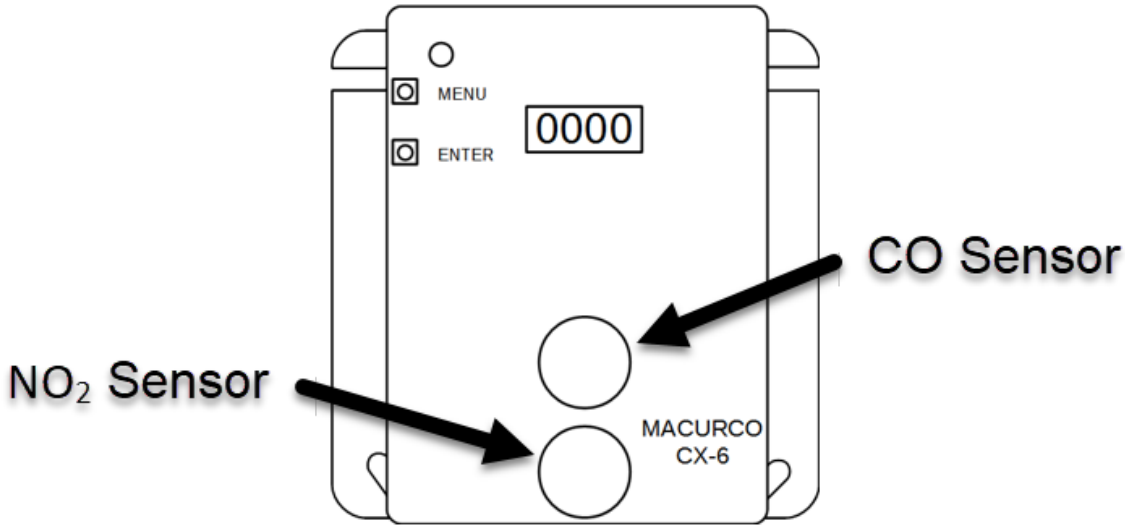

Figure 5-3 - Replacement Sensor Location

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6 Maintenance

The CX-xx is low maintenance. The unit uses two electrochemical sensors that have a 2-year life expectancy (in normal conditions). The detector's performance should be tested regularly by using gas as detailed in the Gas Testing and Field Calibration Procedure sections.

All maintenance and repair of products manufactured by Macurco are to be performed at the appropriate Macurco manufacturing facility. Macurco does not sanction any third-party repair facilities.

6.1 Sensor Life Reset

To reset the sensor life,

1. Remove the Philips screw on the front of the CX-xx. Pull the front cover of the unit off.
2. From normal or warm-up mode, press **Next** 4 times to get to "SEn" or Sensor Mode.
3. Press **Enter**. The display will read "rSt.C".
    a. To reset the CO sensor life, press **Enter**.
    b. To reset the NO2 sensor life, press **Next** once. The display will read "rSt.n". Press **Enter**.
4. If the sensor life has already been reset, done "don" will be displayed. If it has not already been reset, "no" will be displayed. Press **Next** to change it to "YES" (flashing).
5. Press **Enter** to confirm the change (solid) and press **Enter** again to return to the "SEn" menu.
6. Press **Next** until "End" is displayed.
7. Press **Enter** to get back to normal operation. The sensor life will be reset for 2 years.

NOTE: Once the corresponding sensor life is reset, the unit will display calibration overdue for the corresponding sensor forcing the user to calibrate the unit before use. After a successful field calibration, the calibration overdue will be resolved, and the detector will go into normal mode.

NOTE: The detector does not need to be replaced when a sensor is expired. Once it displays sensor expired, the user can replace the sensor on the detector, calibrate the unit and start using it.

⚠ WARNING
Do not disassemble unit or attempt to repair or modify any component of this instrument. This instrument contains no user serviceable parts, and substitution of components may impair product performance.

CAUTION

Avoid the use of harsh cleaning materials, abrasives and other organic solvents. Such materials may permanently scratch the surfaces and damage the display window, labels, sensor or instrument housing. High voltage terminals (100-240VAC) are located within this detector, presenting a hazard to service technicians. Only qualified technicians should open the detector case and service the internal circuits. Ensure power is removed from the detector prior to cleaning the unit. Failure to do so may result in sickness or death.

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6.2 Cleaning

Cleaning of the external surfaces is best carried out using a damp cloth with a mild detergent or soap. Use a vacuum cleaner with soft brush to remove dust or contamination under the cover. Do not blow out the sensor with compressed air.

7 Testing

⚠WARNING

Using a certified gas with a concentration other than the one listed for this detector when conducting a calibration verification test (bump test) will produce inaccurate readings. This means that higher levels of the gas being monitored may be present and could result in overexposure. For proper use, see supervisor or User manual, or contact Technical Support at 1-844-325-3050.

All CX-xx units are factory calibrated and 100% tested for proper operation. During normal operation the green status indicator LED light will be on steady, the fan & alarm relay will be in standby mode and the 4-20 mA output will be at 4mA (in clean air). The unit also performs a regular automatic self-test during normal operation. If the unit detects an improper voltage or inoperable component, it will default into Error mode. In this error mode, the Alarm relay will be activated, the 4-20 mA current loop will go to 24 mA, the unit will display the error code, the green status indicator LED light will flash, and the buzzer will chirp intermittently. The Fan relay will also engage if the Trouble Fan Setting Option is set to “ON”.

7.1 Testing

7.1.1 Operation Test

Check that the green CX-xx status indicator LED light is illuminated continuously. If not, do not proceed with the tests. If the unit is in error mode, contact your local representative or Macurco technical service representative for information on resolving the problem.

1. Remove the single screw in the middle of the front cover of the CX-xx.
2. Remove the front cover.
3. Observe the LED light on the front of the CX-xx.
4. If the light is solid green proceed to step 6.
5. If the green status indicator LED light is off or flashing, refer to the General section above.
6. Press **Enter**.
7. The CX-xx will step through a cycle test:
    a. The display progresses through the bUZ (Buzzer Test) Art (alarm relay test), Frt (fan relay test) then 42t.C and 42t.n (4-20 mA output test). Make sure that the settings are “on” or not disabled “diS”.

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Test	Description	Test Length	Display
bUZ	Buzzer Test	3 seconds	Flashes “bUZ”
Art	Alarm Relay Test	5 seconds	Flashes “Art”
Frt	Fan Relay Test	60 seconds	Flashes “Frt”
42t.C	4-20 mA Test for CO	130 seconds	Flashes “42t.C”
42t.n	4-20mA Test for NO_2	130 seconds	Flashed “42t.n”

Figure 7-1 - Operation Test Mode Table

b. At the end of the test cycle, the fan & alarm relay will be in standby mode and the 4-20 mA output will return to 4 mA (in clean air).

8. When testing is complete, reassemble the unit.

7.1.2 Manual Operation Test

This option gives the user the opportunity to manually initiate an individual test for each relay, the analog output and the sensor response to gas.

To initiate a manual operation test,

1. From normal operation mode press **Next** 2 times to get to Test Mode (tSt).
2. Press **Enter** once to get into the Test Menu.
3. Press **Next** to scroll through the six test options.

Test	Description	Test Length	Display
bUZ	Buzzer Test	3 seconds	Flashes “bUZ”
Art	Alarm Relay Test	5 seconds	Flashes “Art”
Frt	Fan Relay Test	60 seconds	Flashes “Frt”
42t.C	4-20 mA Test for CO	130 seconds	Flashes “42t.C”
42t.n	4-20 mA Test for NO_2	130 seconds	Flashes “42t.n”
gtS	Gas Test	180 seconds	Flashes in a sequence of gtS, CO reading (indicated by C in the beginning) and NO2 reading (indicated by n in the beginning). No output to the panel during the gas test.

Figure 7-2 – Manual Operation Test Mode Table

4. Press **Enter** to initiate the selected test. Note that if the relay or 4–20 mA output has been disabled, the test selection will not be displayed in the test menu.
5. Once the test is complete, the display will return to steady display. To exit the test menu, press the **Next** button until “End” is displayed. Then, press **Enter** to return to normal mode.

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7.2 Calibration and Test Kits

⚠WARNING

The following steps must be performed when conducting a calibration verification test (bump test) to ensure proper performance of the monitor. Failure to do so may adversely affect product performance.

- When performing a calibration verification test (bump test) only use certified calibration gas at the required concentration level.
- Do not test with expired calibration gas.
- Do not cover or obstruct display or visual alarm cover.
- Ensure sensor inlets are unobstructed and are free of debris

Failure to follow instructions outlined in this user manual can result in sickness or death.

- When performing a calibration or calibration verification test (bump test) only use certified calibration gas at the required concentration level. Do not calibrate with expired calibration gas.
- If the instrument cannot be calibrated, do not use until the reason can be determined and corrected.
- Do not cover or obstruct display or visual alarm cover.
- Ensure sensor inlets are unobstructed and is free of debris

A Field Calibration Kit, Cal-Kit 2, and two bottles of calibration gas are needed to complete gas test. These are available through local distribution or from Macurco.

NOTE: CX-xx must be tested or calibrated at regular intervals in accordance with the requirements of the National Fire Protection Association (NFPA) 720 or local code requirements. It is recommended to test or calibrate CX-xx at least annually.

Contents of the Cal-Kit 2

- Cal-Kit 2 (30-0021-1110-1)
  - Calibration Case
  - Two feet of Tygon tubing
  - Cal Hood-Macurco Pack
  - 0.2 LPM Gas regulator (M)

Also needed are the following calibration gas bottles (Sold Separately):

- Qty 1 CO-200PPM-AL (70-0714-0531-4) Carbon Monoxide CO Cal Gas Aluminum Cylinder 34L 200 ppm (F)
- Qty 1 NO2-5PPM-AL (70-0714-0531-3) Nitrogen Dioxide NO2 Cal Gas Aluminum Cylinder 34L 5 ppm (F)

Cal-Kit 2 Information

Several detectors can be calibrated with one Cal-Kit. The only limitation is the amount of gas in the cylinder. The 34-liter cylinder has approximately 170 minutes of continuous calibration run time. The gas cylinder should be replaced when the pressure gauge on the regulator shows 25-psi or less.

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Note: For optimum test results it is suggested that the unit be in clean air, green light on, and be in a low ambient air flow.

It is critical to perform zeroing of the sensor in clean air. In the situation or application where the absence of target gas (CO or NO_2) cannot be guaranteed, it is suggested to use Zero Air (20.9% O_2 balance nitrogen) calibration gas for zeroing of the sensor.

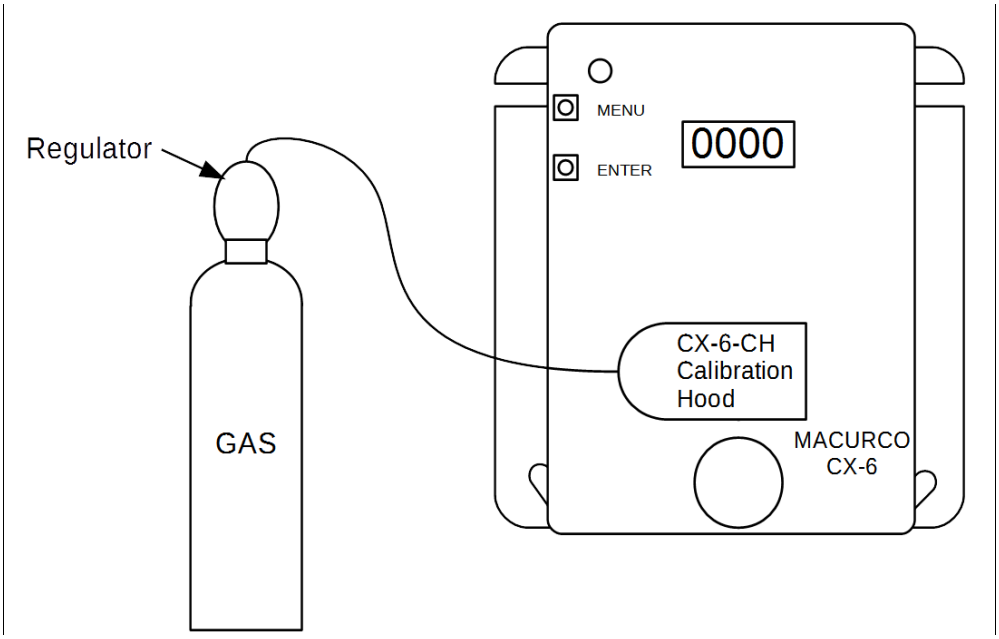

Figure 7–1 - Calibration Kit Connection

7.3 Gas Testing

7.3.1 Testing the Fan Relay

1. Remove the Philips screw on the front of the CX-xx. Remove the front cover.
2. Open the FCK. Connect the gas cylinder to the regulator.
3. Check the pressure gauge on the regulator. If you have 25-psi or less, you will need to replace the gas canister.
4. Assemble the regulator, hose, and Calibration Hood and place the Calibration Hood over the sensor to be tested.
   NOTE: The time to activate the Fan Relay depends on the Fan Relay Delay "Frd" setting.
5. Turn on the regulator to start the gas flow and wait with the gas applied continuously.
6. With the display function turned "On", the CX-xx will flash between the current concentration of CO and NO_2, or "0" (zero) in clean air. When the gas concentration reaches the Fan Relay setting, the display will flash between "FAn" and "current gas reading". With the display function turned" Off", the display does not show the gas concentration, but will show "FAn" while the fan relay is activated.

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NOTE: If the Fan Relay does not close within 2 minutes, there are four possibilities:

a. Gas cylinder is empty, check the pressure gauge. Replace the gas cylinder if 25psi or less.
b. Unit needs to be re-calibrated (go through recalibration and re-test).
c. Detector needs servicing (return unit to factory for servicing).
d. The detector has the Fan Relay set to disable ("diS") or a concentration level higher than the test gas. Set the Fan Relay to a gas concentration lower than the test gas and repeat the test.

7. Remove the gas from the sensor. Proceed to test the Alarm Relay or replace the top cover.

7.3.2 Testing the Alarm Relay

1. Connect the gas cylinder to the regulator.
2. Check the pressure gauge. If there is 25psi or less the cylinder should be replaced.
3. Place the Calibration Hood over the sensor.
4. Turn on the regulator to start the gas flow. The Alarm Relay should activate according to the settings.
5. With the display function turned "On" and the gas concentration reaching the Alarm Relay setting, the display will flash between "ALr" and "current gas reading". The buzzer will sound indicating "Alarm" if the buzzer is turned "On". With the display function turned off the display does not show the gas concentration but will show "ALr" when the Alarm Relay is activated.

   Note: If the Alarm Relay fails to operate within 2 minutes, there are four possibilities:

   a. Gas cylinder is empty. Check the pressure gauge. Replace the gas cylinder if 25-psi or less.
   b. Unit needs to be re-calibrated (go through recalibration and re-test).
   c. Detector needs servicing (return unit to factory for servicing).
   d. The detector has the Alarm Relay set to disable ("diS") or a concentration level higher than the test gas. Set the Alarm Relay to a gas concentration lower than the test gas and repeat the test.

6. Remove the gas from the sensor after Test. Proceed to Test the 4-20mA output or replace the top cover.

7.3.3 Testing the 4-20mA loop

1. Make sure the 4-20mA mode is set to "HigH" for this test.
2. Connect the gas cylinder to the regulator.
3. Check the pressure gauge. If there is 25-psi or less the cylinder should be replaced.
4. Place the cap from the regulator over the sensor. Turn on the regulator to start the gas flow.
5. The Fan relay should activate according to the settings.
6. The Alarm relay should activate according to the settings.
7. The 4-20mA output should ramp up from 4mA in clean air to 20mA at 200 ppm CO and 20mA at 20 ppm NO_2. See Figure 3–1 and Figure 3–2.

   Note: If the 4-20mA output does not ramp up within 2 minutes, there are four possibilities:

   a. Gas cylinder is empty, check the pressure gauge. Replace the gas cylinder if 25-psi or less.
   b. Unit needs to be re-calibrated (go through recalibration and re-test).
   c. Detector needs servicing (return unit to factory for servicing).
   d. Detector has 4-20 mA option set to "OFF". Set 4-20mA option to "bAS" and repeat the test.

8. Remove the gas from the sensor. Re-assemble the CX-xx (make sure the LED is aligned with the front case hole). You are done.

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7.3.4 Aerosol Carbon Monoxide Test (Carbon Monoxide only)

The CME1-FTG is an 11L 500 ppm Aerosol Carbon Monoxide Field Test Gas that can be used with the CX-xx. This field test gas allows installers to do a quick functionality test of the CO sensor. The flow rate of the CME1-FTG is 10 Lpm so you will have about a minute of gas or enough to test 20-30 sensors.

1. Units to be tested must be powered continuously for a minimum of 3 minutes before proceeding.
2. For optimum test results the unit should be in clean air and be in a low ambient air flow.
3. Check that the CX-xx status indicator light is illuminated, Green continuously. If not, do not proceed with tests. See section 5.1 On-Board Diagnostics.
4. The display option should be set to "On" and reading 0 ppm in clean air.
5. With the CX-xx cover on, aim the nozzle of the aerosol can into the sensor grate area (under DO NOT PAINT) and press for 2 to 3 seconds.
6. Wait for a few seconds. The digital display should climb indicating the increased gas concentration at the sensor confirming a pass of the quick test.
   Note: If the Display does not change within 10 seconds, there are four possibilities:
   a. Gas cylinder is empty, replace the gas cylinder.
   b. Unit needs to be re-calibrated (go through the Field Calibration Procedure and re-test).
   c. Detector needs servicing (return unit to factory for servicing).
7. Wait for the display to return to 0 ppm and configure options to desired settings.

7.4 Field Calibration Procedure

NOTE: For optimum calibration results the unit should be in clean air and be in a low ambient air flow.

CX-xx has "CAL" top level menu that can be used to perform a field calibration. "tSC.C", "tSC.n", "000.C", "000.n", "Spn.C", "Spn.n", and "End" are sub-menus within the "CAL" menu.

- **"tSC.C"** and **"tSC.n"** are read only and represent the time since last calibration for each sensor. Select either sub-menu and it will display a value in the format YY.MM. "MM" are for months and "YY" for year. E.g. if the value is 00.05 then it has been zero years and 5 months since the unit was last calibrated.
- **"000.C"**and **"000.n"** are used to start a zero calibration for each respective sensor. Follow the procedures below to perform a zero calibration.
- **"Spn.C"** and **"Spn.n"** are used to start a span calibration for each respective sensor. Follow the procedures below to perform a span calibration.
- **"End"** sub-menu is used to exit the "CAL" menu.

A complete field calibration requires a zero calibration and a span calibration. A zero calibration provides a reference value by exposing the sensor to clean air. A span calibration exposes the sensor to a known concentration of test gas.

7.4.1 Zero Calibration for CO Sensor

To perform a zero calibration for the CO sensor,

1. Press **Next** 3 times to get to the "CAL" menu
2. Press **Enter**. The display will show "tSC.C".
3. Press **Next** 2 times to get to "000.C" and Press **Enter**.
4. The display will flash between '000.C' and the current CO reading i.e. "C 0".

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5. After approximately 45 seconds, the zero calibration is complete. For a successful zeroing, the display will flash between “PAS.C” and the current CO reading “C 0”. If the zero calibration fails, the display will show FAil.C.
6. The green LED blinks during the process. When the green LED returns to solid, the calibration is complete.

7.4.2 Zero Calibration for NO_2 Sensor

To perform a zero calibration for the NO_2 sensor,

1. Press **Next** 3 times to get to the “CAL” menu
2. Press **Enter**. The display will show “tSC.C”.
3. Press **Next** 3 times.
4. The display will show “000.n”. Press **Enter**.
5. The display will flash between ‘000.n’ and the current NO_2 reading i.e. “n 0.0”.
6. After approximately 45 seconds, the zero calibration is complete. For a successful zeroing, the display will flash between “PAS.n” and the current NO_2 reading “n 0.0”. If the zero calibration fails, the display will show FAil.n.
7. The green LED blinks during the process. When the green LED returns to solid, the calibration is complete.

7.4.3 Span Calibration for CO Sensor

To perform a span calibration for the CO sensor,

1. Remove the Philips screw on the front of the CX-xx. Pull the front cover of the unit off.
2. Assemble the CO gas cylinder and regulator together.
3. Check the pressure gauge on the regulator. If you have 25-psi or less you will need to replace the gas canister.
4. Place the test Hood from the regulator over the CO sensor.
5. Press **Next** 3 times to get to the “CAL” menu
6. Press **Enter**. The display will show “tSC.C”.
7. Press **Next** 4 times for “Spn.C” (CO).
8. Press **Enter**. The display will flash between “GAS.C” and “200”.
9. Start applying gas to the sensor.
   Note: The sensor will look for the gas for 90 seconds. If no gas is applied or detected in that time, the display will return to “CAL”.
10. When the sensor detects the gas, the display will flash between the “gas concentration” and “SPn.C”, then the calibration will progress, and the display will show the gas level for a maximum of 165 seconds.
11. When the calibration is successful, the display will flash between the “gas concentration” and “PAS.C”, then the display will show the calibration gas level and the calibration is done.
12. If the calibration fails, the display will flash between the “gas concentration” and “FAil.C”. If this occurs, check the pressure gauge on the regulator. If the pressure is less than 25 psi the flow of gas may not be adequate to properly calibrate the unit. If there is proper pressure in the cylinder repeat steps 4 through 6. If the unit fails to calibrate twice contact Technical Assistance: 1-877-367-7891.
13. Once the calibration has passed, remove the calibration hood and disassemble the cylinder and regulator.
14. Re-assemble the CX-xx (make sure the LED is aligned with the front case hole). Calibration is complete.
15. See Calibration Flowchart on the inside of the housing.

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7.4.4 Span Calibration for NO_2 Sensor

To perform a span calibration for the NO_2 sensor,

1. Remove the Philips screw on the front of the CX-xx. Pull the front cover of the unit off.
2. Assemble the NO_2 gas cylinder and regulator together.
3. Check the pressure gauge on the regulator. If you have 25-psi or less you will need to replace the gas canister.
4. Place the test Hood from the regulator over the NO_2 sensor.
5. Press **Next** 3 times to get to the "CAL" menu
6. Press **Enter**. The display will show "tSC.C".
7. Press **Next** 5 times for "Spn.n" (NO_2).
8. Press **Enter**. The display will flash between "GAS.n" and "5.0".
9. Start applying gas to the sensor.
   Note: The sensor will look for the gas for 90 seconds. If no gas is applied or detected in that time, the display will return to "CAL".
10. When the sensor detects the gas, the display will flash between the "gas concentration" and "SPn.n", then the calibration will progress, and the display will show the gas level for a maximum of 165 seconds.
11. When the calibration is successful, the display will flash between the "gas concentration" and "PAS.n", then the display will show the calibration gas level and the calibration is done.
12. If the calibration fails, the display will flash between the "gas concentration" and "FAil.n". If this occurs, check the pressure gauge on the regulator. If the pressure is less than 25 psi the flow of gas may not be adequate to properly calibrate the unit. If there is proper pressure in the cylinder repeat steps 4 through 6. If the unit fails to calibrate twice contact Technical Support : 1-844-325-3050.
13. Once the calibration has passed, remove the calibration hood and disassemble the cylinder and regulator.
14. Re-assemble the CX-xx (make sure the LED is aligned with the front case hole). Calibration is complete.
15. See Calibration Flowchart on the inside of the housing.

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8 Appendix A – Table of Figures

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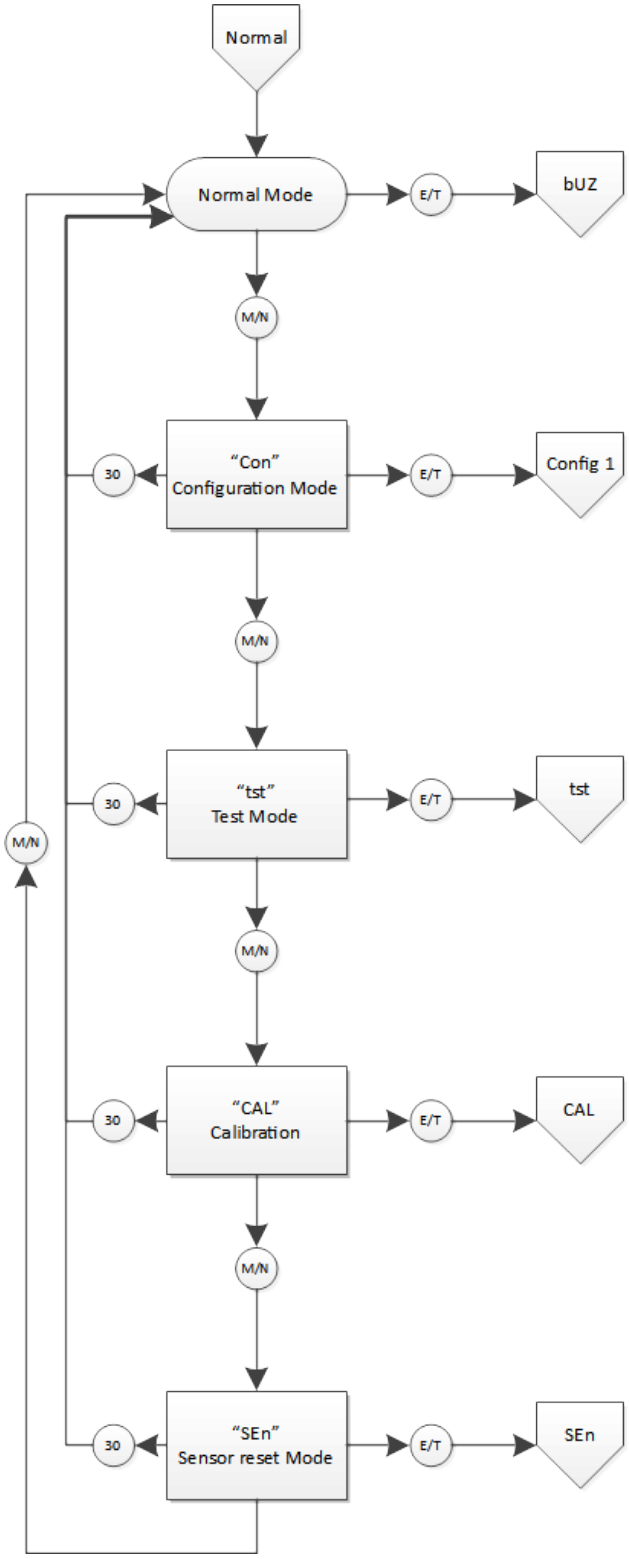
9 Appendix B – Menu Structure

9.1 Main Menu



NOTES:
1. Firmware version 2.01.

NOTES:
1. Sensor settings are in the sensor settings spreadsheet. Any settings here are for demo purposes only.
2. RED indicates where changes are made to the configuration.
3. quotation marks are what is shown on the display. When there are two strings within quotation marks separated by a slash (e.g. " /_On") this indicates display alternating between the strings.

M/N — Menu / Next Button

E/T — Enter / Test Button

XX — Wait for XX seconds

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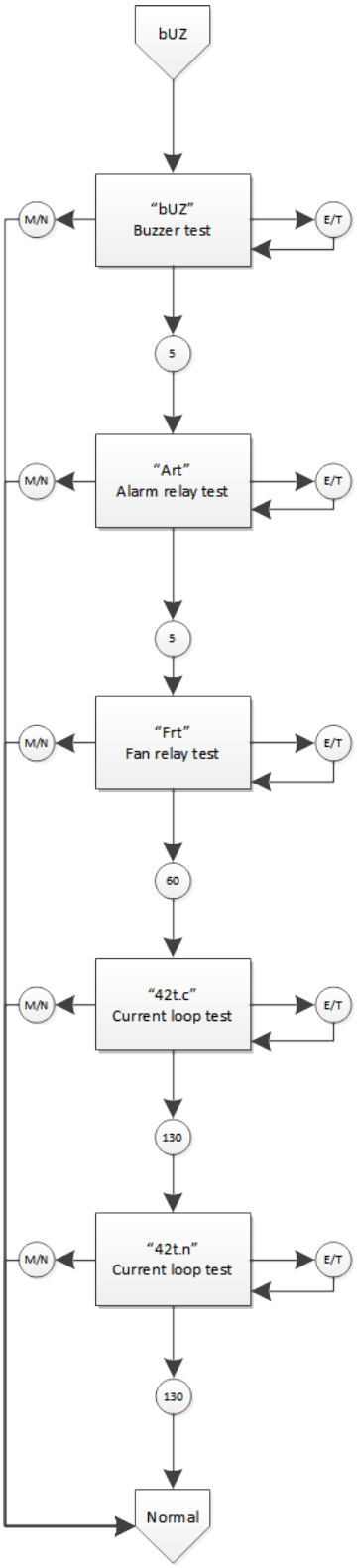
9.2 Auto Test Menu “bUZ”



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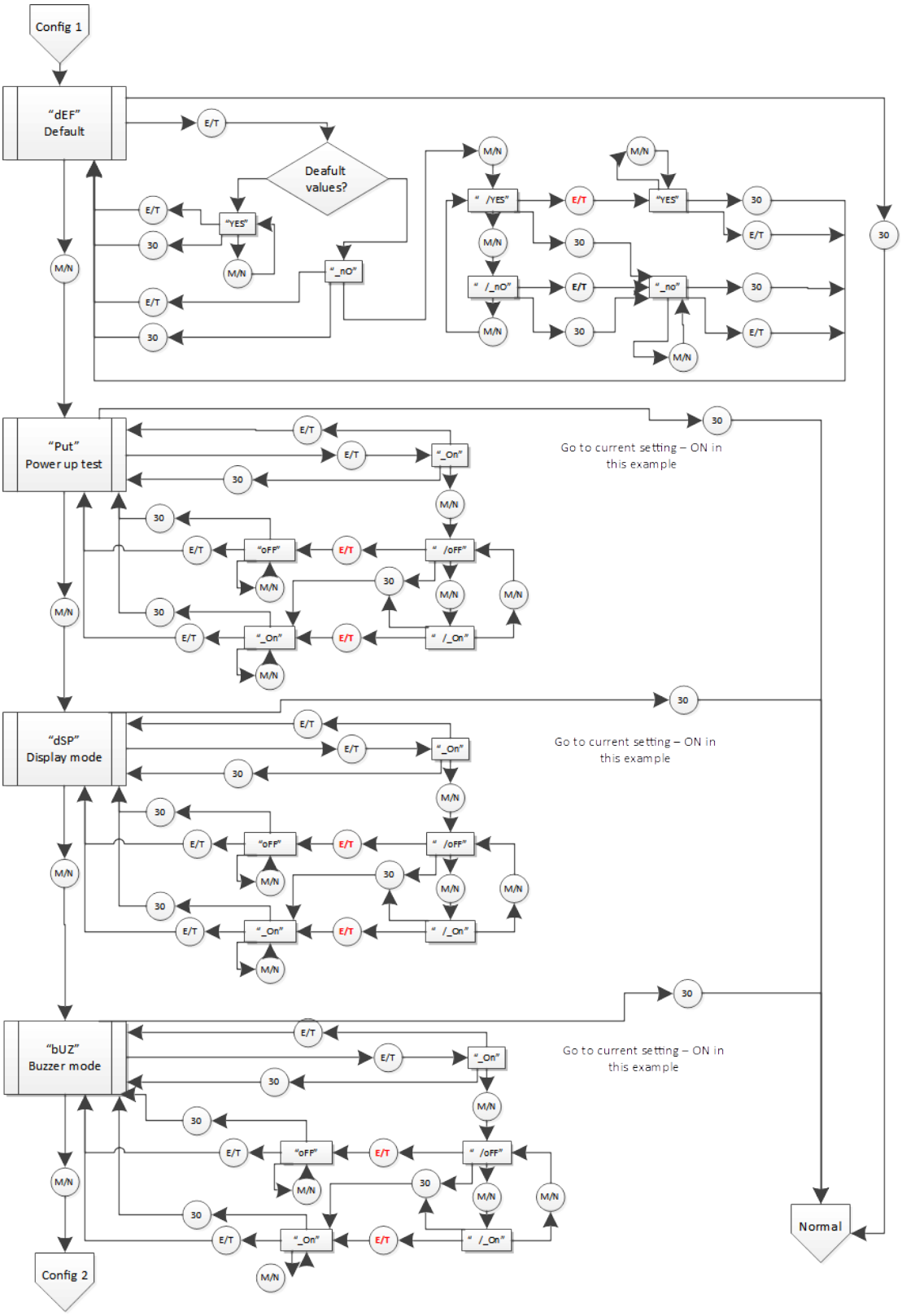
9.3 Configuration Menu “CON”



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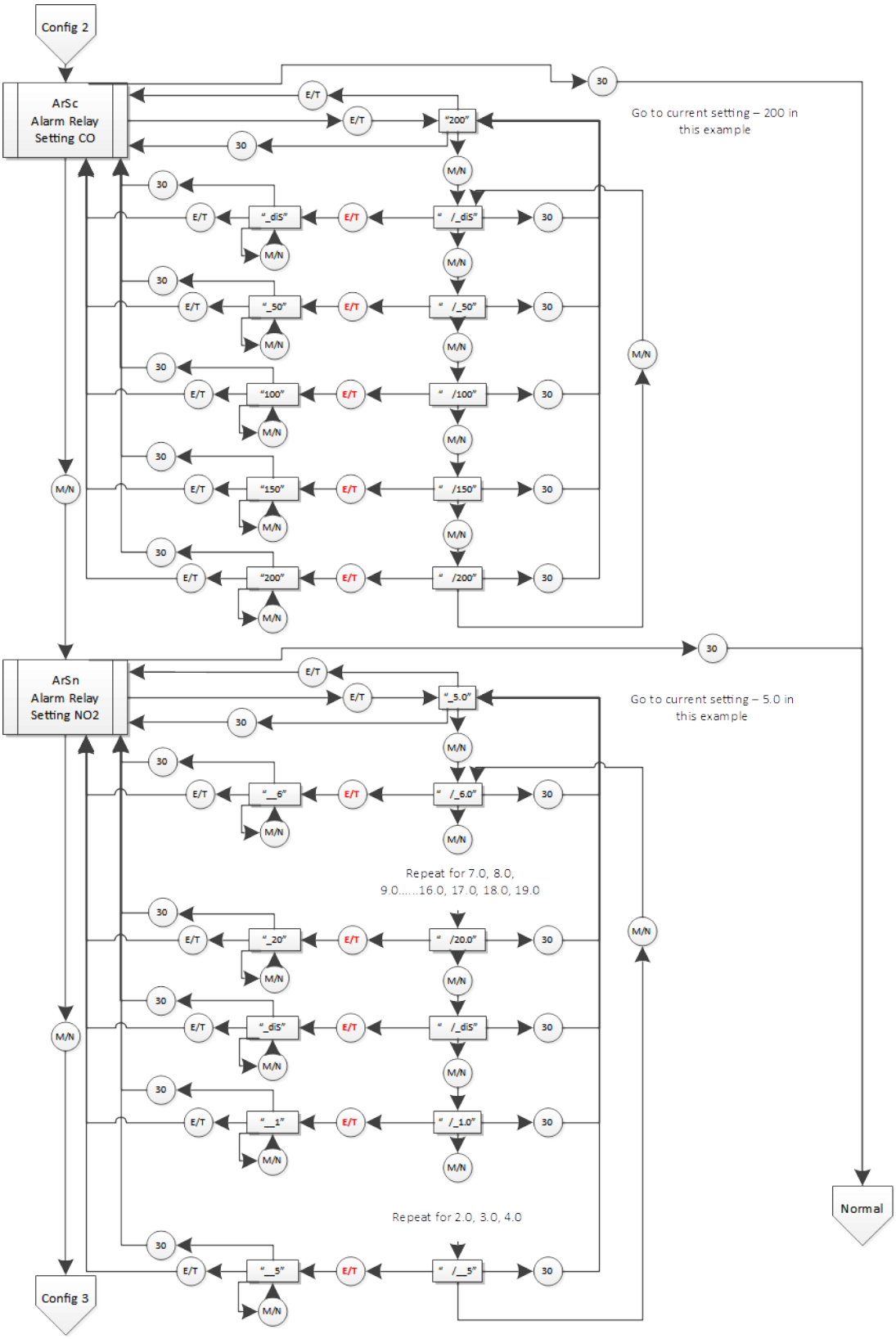

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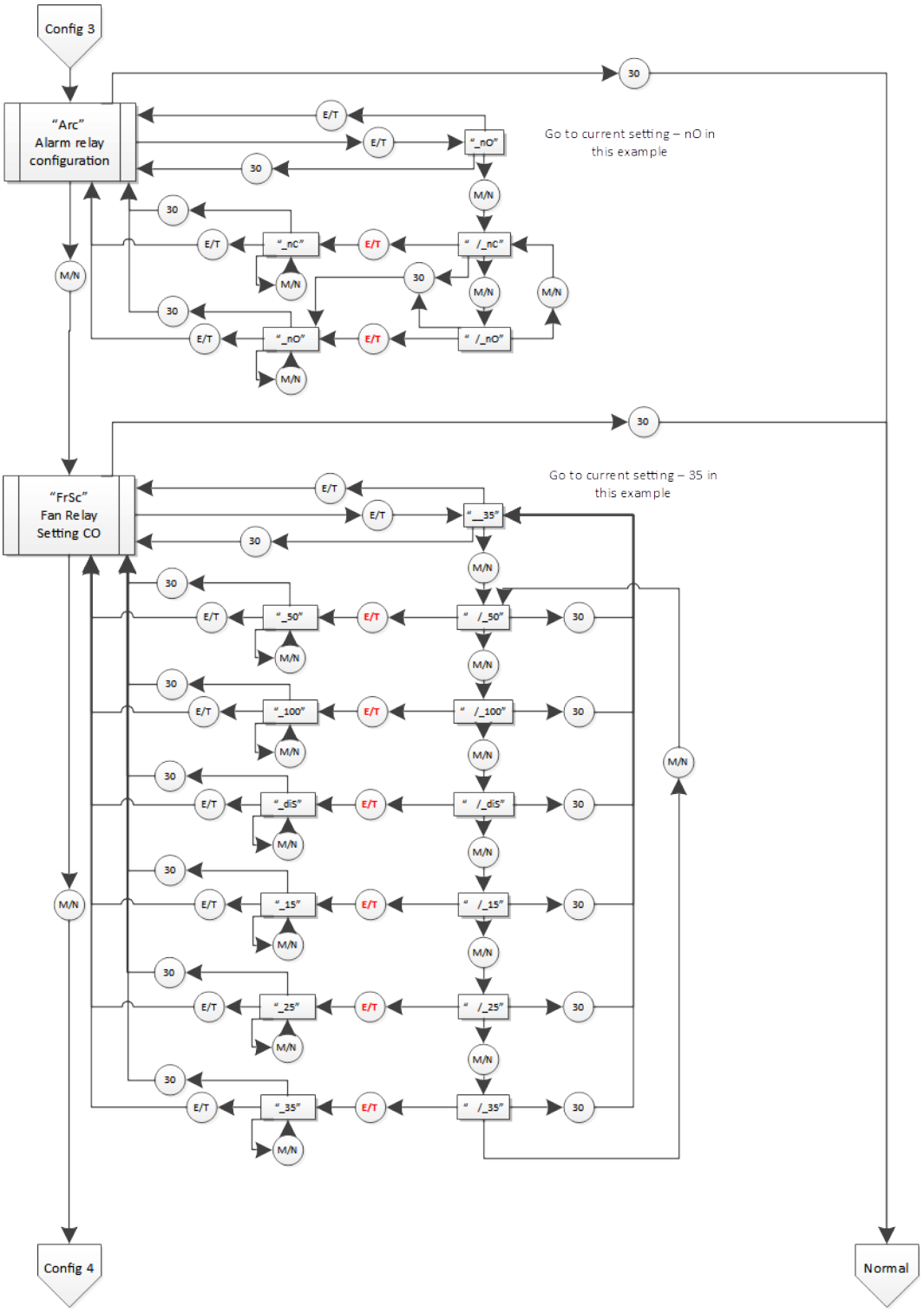

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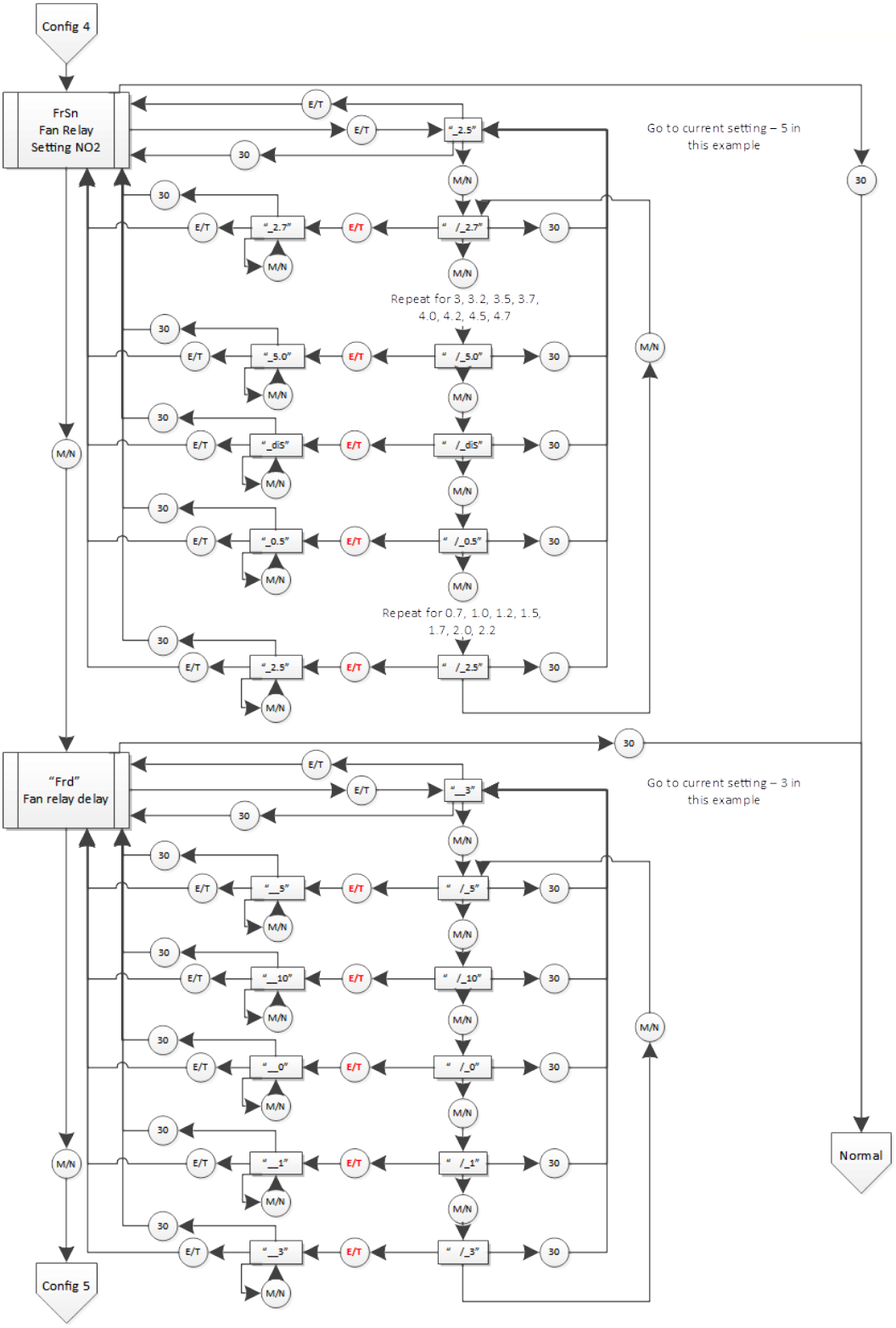

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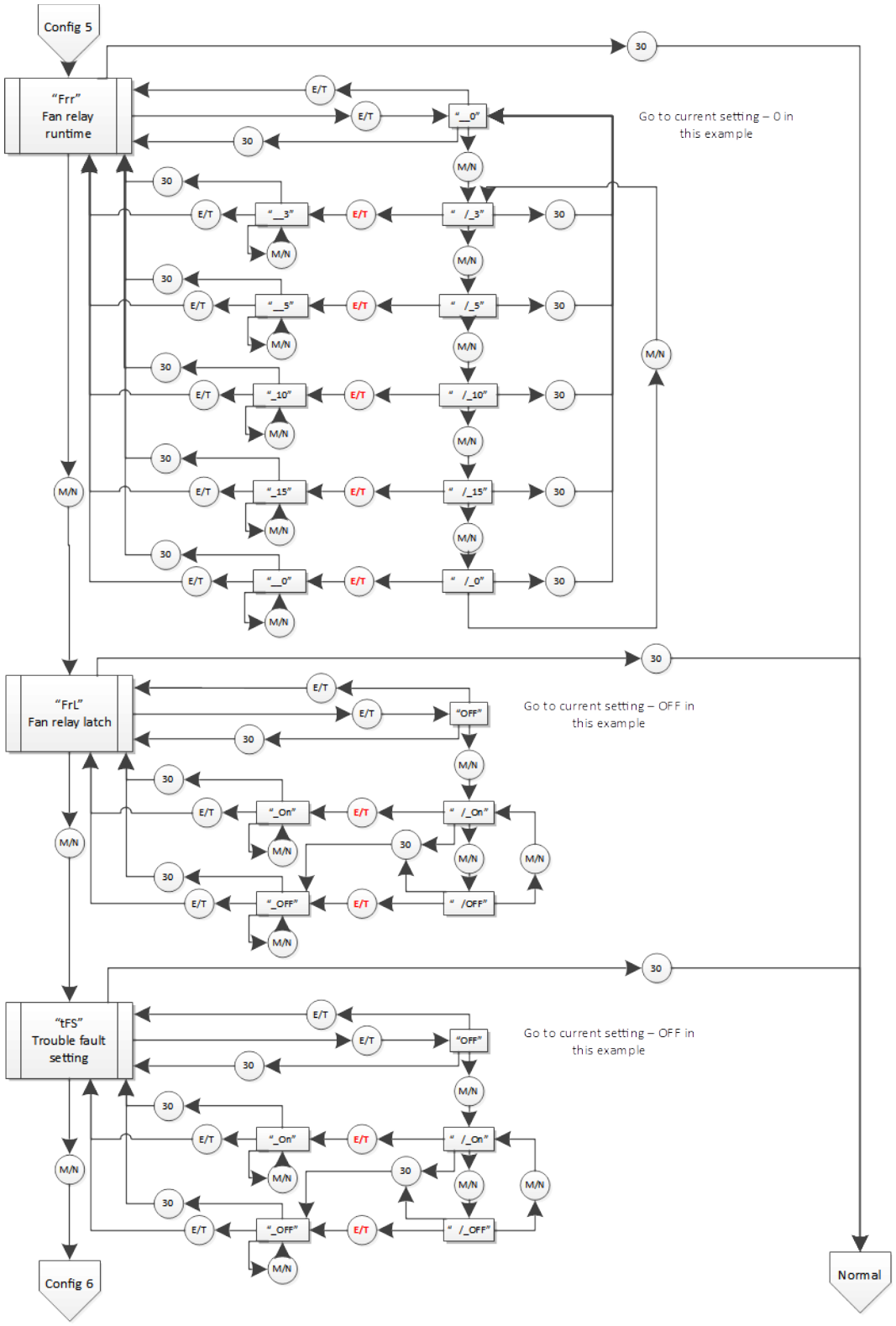

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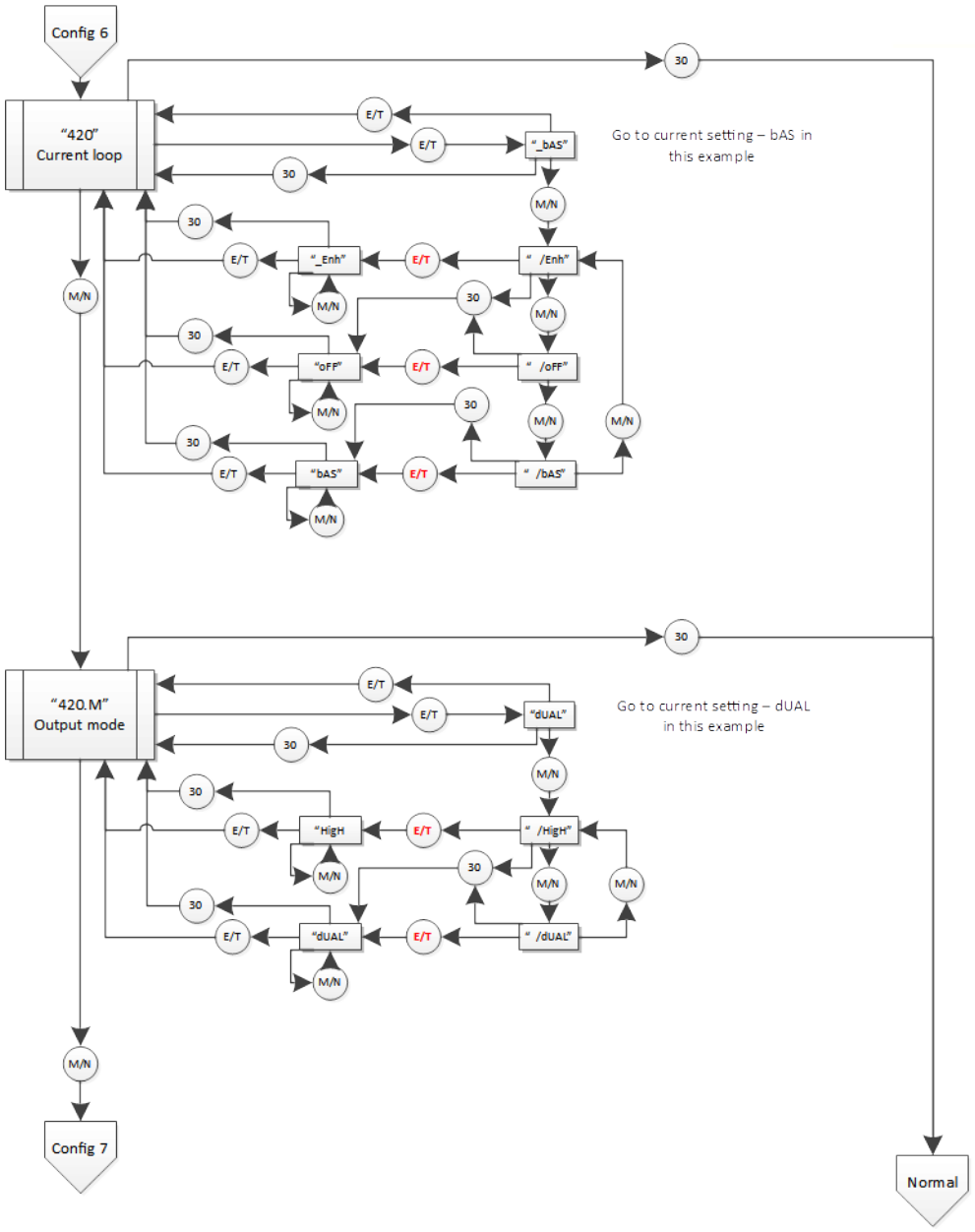

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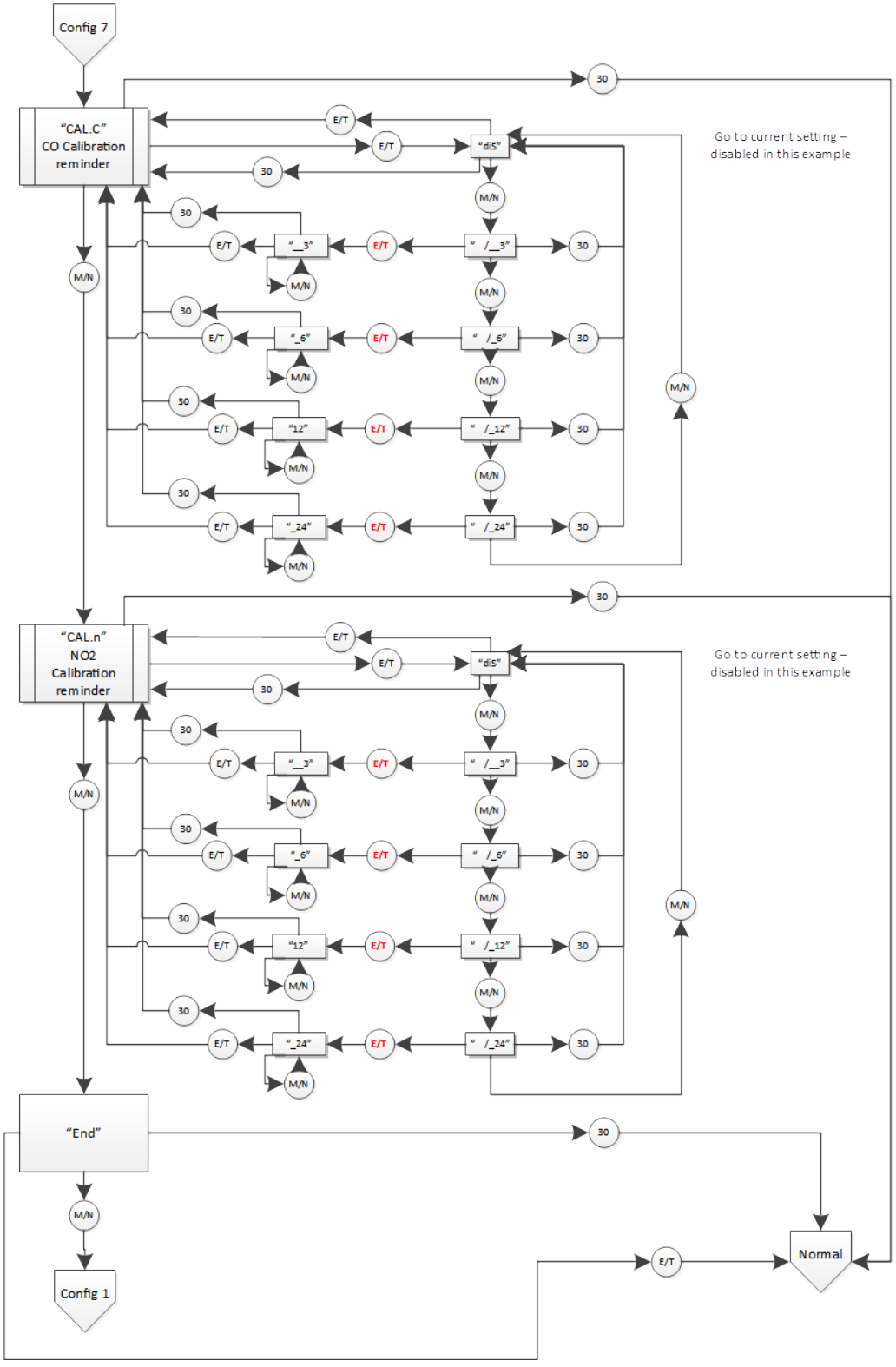

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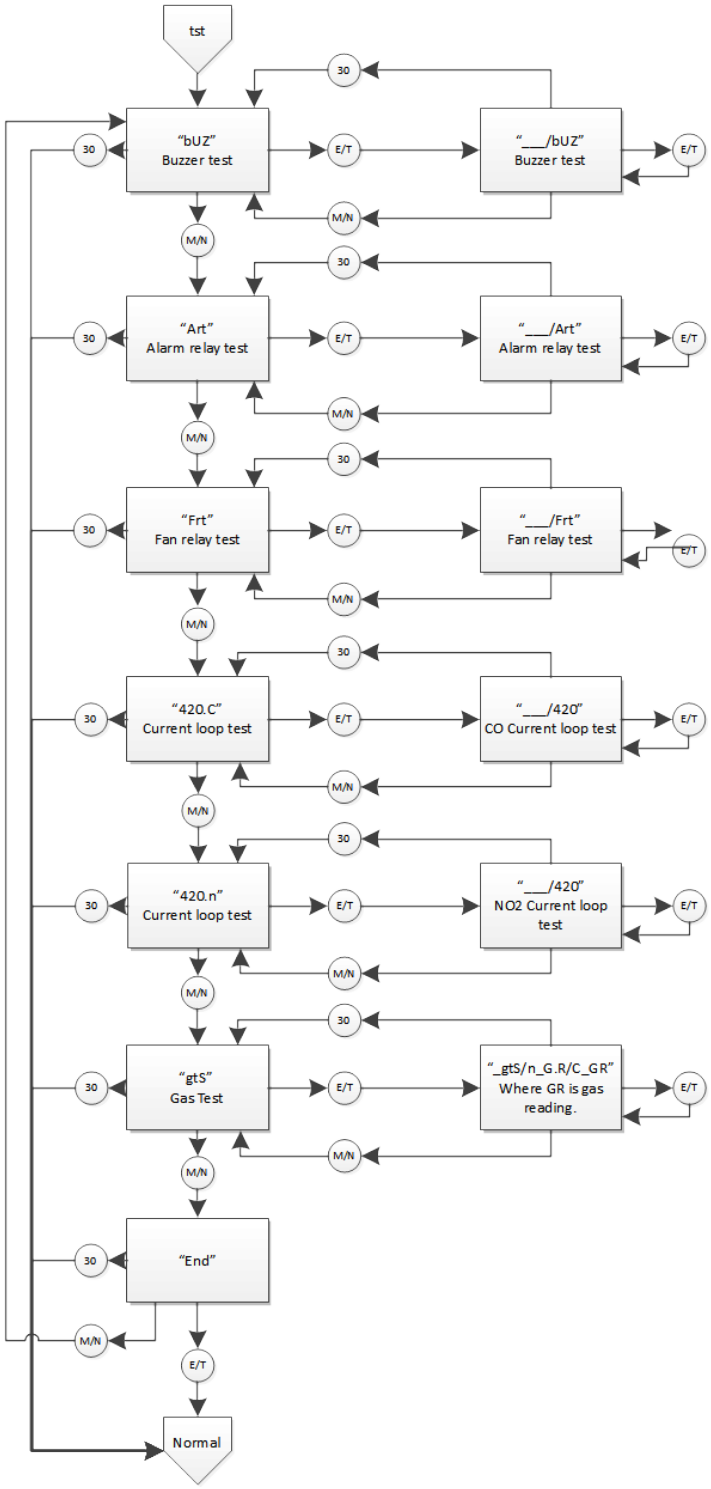
9.4 Select Test Menu “tst”



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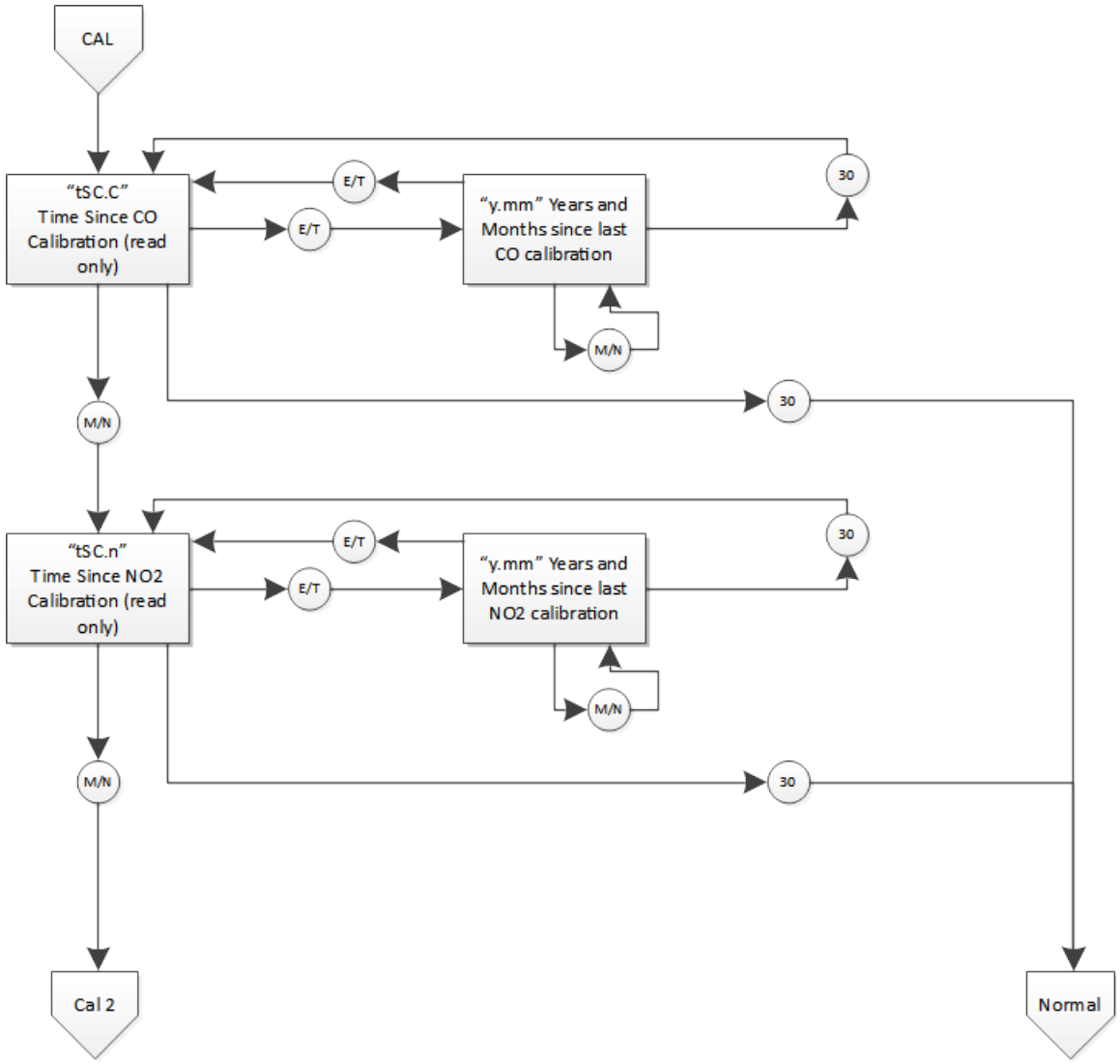
9.5 CAL Menu



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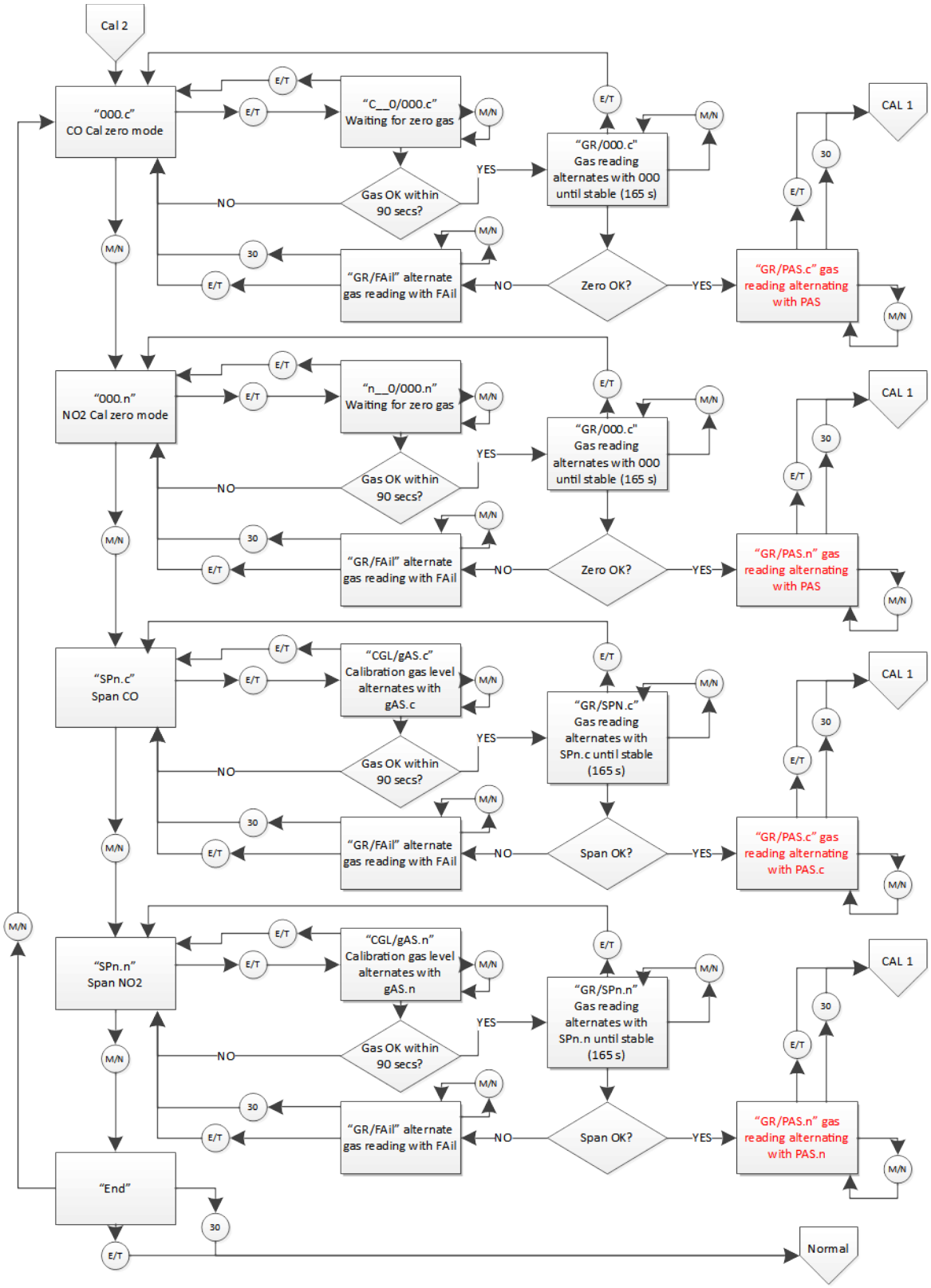

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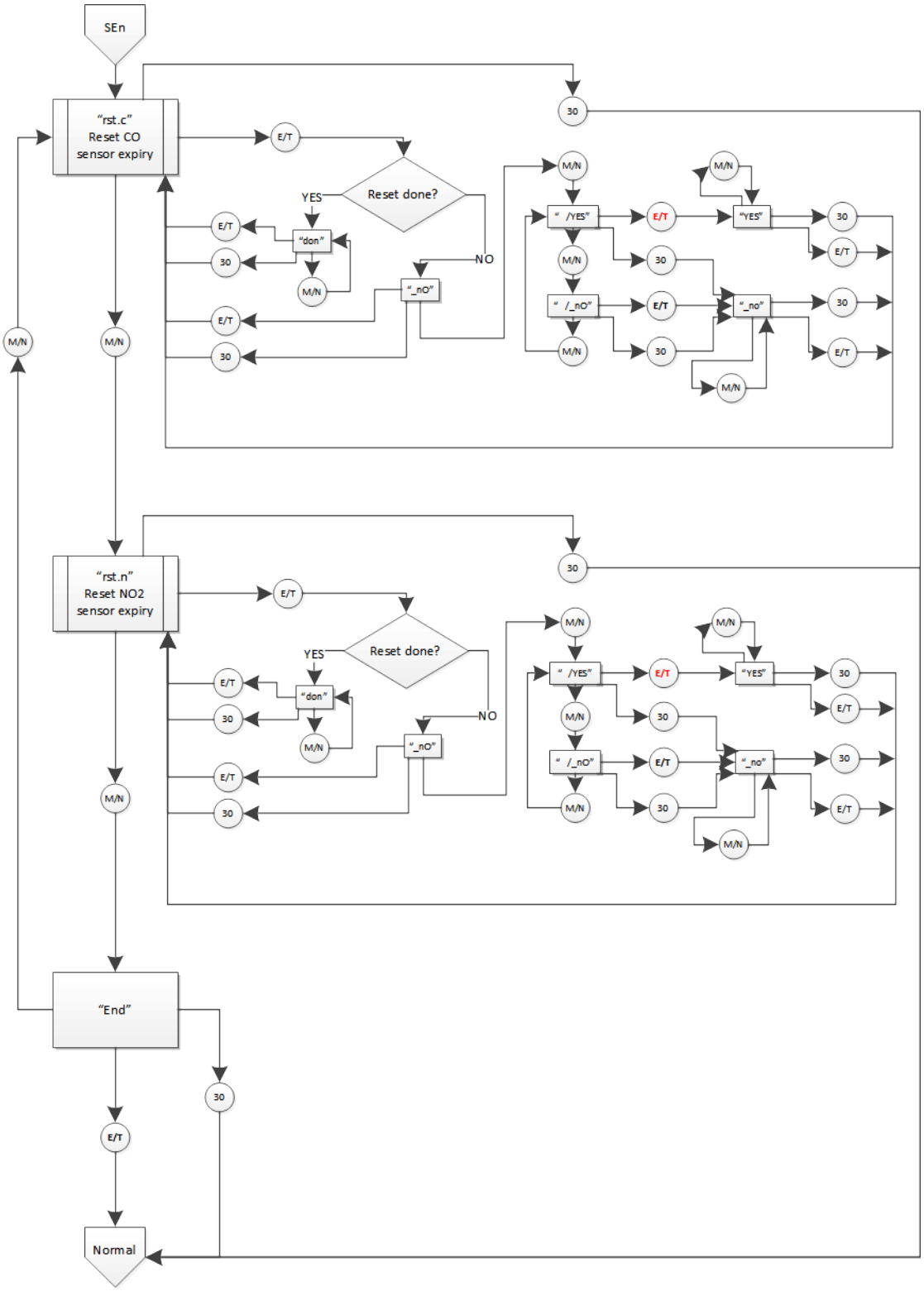
9.6 SEn Menu



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10 Macurco Gas Detection Product limited warranty

Macurco warrants the CX-xx gas detector will be free from defective materials and workmanship for a period of two (2) years from the date of manufacture (indicated on a decal on the PCB and on a sticker on the back side of the mounting plate), provided it is maintained and used in accordance with Macurco instructions and/or recommendations. If any component becomes defective during the warranty period, it will be replaced or repaired free of charge, if the unit is returned in accordance with the instructions below. This warranty does not apply to units that have been altered or had repair attempted, or that have been subjected to abuse, accidental or otherwise. The above warranty is in lieu of all other express warranties, obligations or liabilities. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE ARE LIMITED TO A PERIOD OF TWO (2) YEARS FROM THE PURCHASE DATE. Macurco shall not be liable for any incidental or consequential damages for breach of this or any other warranty, express or implied, arising out of or related to the use of said gas detector. The manufacturer or its agent's liability shall be limited to replacement or repair as set forth above. Buyer's sole and exclusive remedies are the return of the goods and repayment of the price, or repair and replacement of non-conforming goods or parts.

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