FIXED POINT LEVEL CONTROL EQUIPMENT SERIES FPC.5

The series FPC.5 equipment is a capacitance operated fixed point level control equipment designed to provide accurate and reliable control of most types of liquids and free flowing solids in hoppers, silos or other containers. The equipment operates on the principle of measuring the capacitance change between a probe and the hopper (earth) when material reaches or leaves the probe. A system comprises a solid state plug-in control module and one or two probe assemblies according to the application and type of control required. The probe(s) are fitted in the hopper or container and the associated control module remotely mounted at any convenient point in a control panel or similar. Where panel space for mounting the module is not available, specially designed wall mounting module enclosures may be supplied.

CONTROL MODES

The FPC.5 equipment can be used to provide two alternative types of control:-

Single Point Control (High or Low Level)

For this type of control one probe assembly and a module type FLT.1R is required. This type of control is mainly used for alarm type systems to initiate visual or audible alarms when a container has reached a predetermined High or Low level condition.

Sequenced Two Level Control (High/Low Level)

For this type of control two probe assemblies and a module type FLT.2R is required. This type of control is mainly used for the direct operation of automatic filling/emptying systems. Sequenced two level control provides the following operating sequence (assuming a fail-safe High module).

(1) With the container empty and both High and Low level probes uncovered the output relay will be energised.

(2) When the container is filled and the material reaches the High level probe the output relay will de-energise.

(3) When the container is emptied and the level falls, the output relay will remain de-energised until the level falls below the Low level probe when it will again energise.

(4) The cycle then repeats.

In the case of a fail-safe Low level module, the above relay states will be reversed.

PROBE ASSEMBLIES

Various mechanical configurations of probe assemblies are available to suit differing applications. In all cases however, the probe will incorporate an encapsulated transducer insert in the probe head. The standard insert Type ICT.6 is most commonly used, but for certain special applications other types of insert may be fitted.

CONTROL MODULES

Two basic types of control module are available as follows:-

Module Type FLT.1R

For use on single point High or Low level applications. The module can be supplied for either fail-safe High or Low level as required and also can be fitted with an adjustable time delay to prevent spurious operation caused by liquid splashing, falling material etc. The module is fitted with a sensitivity control for adjustment of the operating level and an LED indicator to show the output relay operating state.

Module Type FLT.2R

For use on sequenced two level control systems with two separate probe assemblies. The module can be supplied for either fail-safe High or Low level as required and is fitted with two sensitivity controls for independent adjustment of each operating level. An LED indicator is fitted to show the output relay operating state.

OPTIONAL VARIATIONS

The type and variation of a particular module can be determined by checking the rating label on the side of the module. This type number will state either FLT.1R or FLT.2R followed by one or more of the following suffixes:-

Suffix H – The module is set for fail-safe High level i.e. the output relay will be energised (LED illuminated) with no material present and will de-energise when material is present.

Suffix L – The module is set for fail-safe Low level i.e. the output relay will be energised (LED illuminated) with material present and de-energised with no material present.

Suffix T – The module is fitted with a time delay. The Suffix T is then followed be the overall time range adjustment i.e. 0 – 3 seconds, 1 – 10 seconds, 6 – 60 seconds. The time delay operating mode is set via a slide switch on the top of the module. With the switch set to 'Make' the delay will operate on material coming in contact with the probe. With the switch set to 'Break' the delay will operate when the material leaves the probe.

INSTALLATION

(1) Locate the Probe Head(s) in the container at the position(s) where level control of the contents is required. Where the probe(s) are being mounted vertically in the container the tip of the probe should be at least 50 mm below the required detection level to obtain satisfactory operation.

(2) Locate the control module in the desired position. The permissible distance between the module and the probe is virtually unlimited providing cable of a cross sectional area of at least 1.5 mm is used. The maximum lead resistance permissible is 200 ohms.

(3) Connect the equipment in accordance with the appropriate connection diagram given later in these instructions. All wiring can be carried out in ordinary cable, screened cable is not necessary.

(4) It is recommended that the mains supply is fused at 2 amps maximum.

COMMISSIONING

The equipment should be set up with the container empty (probe uncovered). If, due to the nature of the material, build-up on the probe is anticipated, it is advisable to delay setting-up until after build-up has occurred.

SINGLE POINT CONTROL (MODULE FLT.1RH – HIGH LEVEL FAIL-SAFE)

(1) Check all connections are correct, turn all module controls fully anti-clockwise and switch on the mains supply.

(2) Turn the 'Trip' control slowly clockwise until the output relay energises and the LED illuminates. Now advance the control a further two scale divisions. If the LED does not illuminate check the probe head adjustment as detailed under the "Probe Head Adjustment" section of this manual.

(3) Fill the container until the probe is covered and check that the output relay de-energises and the LED goes out signalling material present.

(4) To make the system more sensitive turn the 'Trip' control further clockwise. Do NOT set the system more sensitive than is necessary to obtain satisfactory operation.

(5) Where a time delay is fitted, this can now be set by means of the 'Delay' control and the 'Make/Break' mode selector switch. Turning the 'Delay' control clockwise increases the time delay period up to the maximum stated on the module rating label.

(6) The above instructions relate to a Type FLT.1RH module (fail-safe High level). For a module Type FLT.1RL (fail-safe Low level) the same instructions apply but the specified relay and LED states in Paragraphs 2 and 3 will be reversed.

SEQUENCED TWO LEVEL CONTROL (MODULE FLT.2RH – HIGH LEVEL FAIL-SAFE)

On the module Type FLT.2RH the upper 'Trip' control relates to the High level probe and the lower control to the Low level probe. On the module Type FLT.2RL these controls are reversed.

(1) Check all connections are correct, turn all module controls fully anti-clockwise and switch on the mains supply.

(2) Turn the High level 'Trip' control fully clockwise and then slowly turn the Low level 'Trip' control clockwise until the LED illuminates. Now advance the control a further two scale divisions clockwise.

(3) Note the control setting thus obtained and then return the Low level 'Trip' control to the fully anti-clockwise position. (LED will stay illuminated).

(4) Slowly turn the High level 'Trip' control anti-clockwise until the LED goes off. Now turn the control clockwise two scale divisions. (LED still off).

(5) Return the Low level 'Trip' control to the position noted in 3 above.

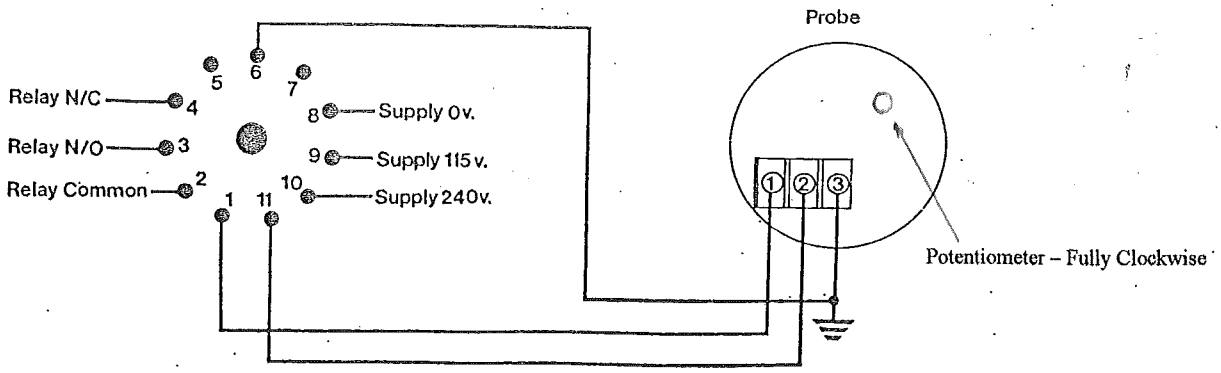
(6) Note that the differential between the High and Low switching levels is obtained by probe positioning and only a minimal adjustment to differential can be obtained by control setting adjustment.

CHANGING HIGH/LOW FAIL-SAFE MODE

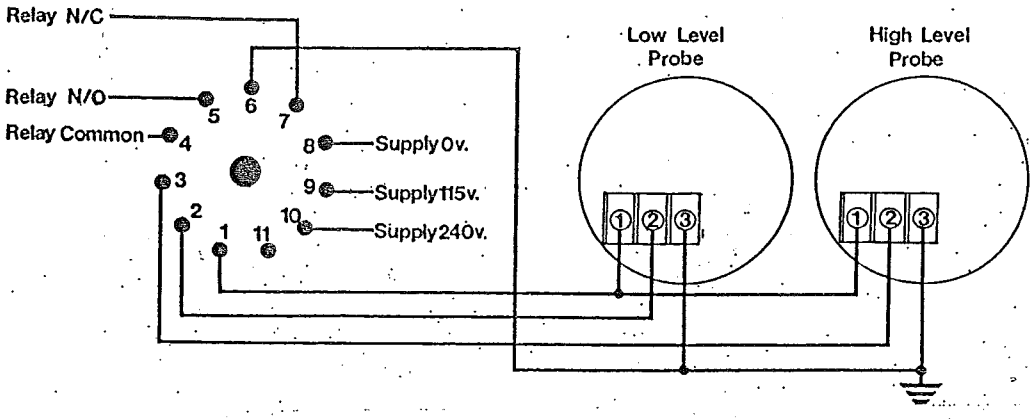
As previously stated both the FLT.1R and FLT.2R modules can be set for Fail Safe High or Low level as required. This is normally set before despatch and the set mode indicated by a Suffix H or L after the module type number on the rating label. If for any reason it is required to change the Fail-Safe mode from that set proceed as follows:-

(1) Remove the two cover retaining screws and slide the cover off the module.

(2) On the copper track side of the larger of the two internal printed circuit boards are three small tags and a wire link as detailed in the diagram below. The position of this link sets the Fail-Safe mode as follows:-



CONNECTIONS MODULE TYPE FLT2R WITH TWO PROBES



CONNECTION NOTES

(1) Always ensure that the mains supply to the module is connected correctly i.e. Pins 8 and 9 for 110 volts or Pins 8 and 10 for 240 volts.

(2) To obtain satisfactory operation it is essential that the probe head housing makes a good contact with earth (the container) either via the 1" BSP fixing nipple or via metal conduit carrying the wires to the probe head.

(3) Note that the output contacts from the FLT.1R and FLT.2R modules are voltage free.

(4) For applications where the probe is in contact with a 'hot' material which would result in the temperature of the ICT insert rising above its maximum rating, the insert can be removed from the probe head and mounted remote. If this is done the insert should be mounted not more than 1 metre from the probe head and the connections between the insert and the probe MUST be made in low loss screened (co-axial) cable. Terminals 4 and 5 on insert are specially provided for this purpose and these should be connected as follows:-

Terminal 4 – Via coax braid to probe head case (Earth).

Terminal 5 – Via coax inner bore to probe rod.

All other connections and setting-up details remain the same.

FAULT DIAGNOSIS

In the event of the equipment not operating after installation and setting-up the following points should be checked.

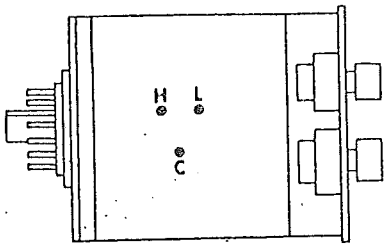
(1) Recheck all connections, particularly the mains supply connections at the module.

(2) Check that Terminal 3 at the probe head is to earth (the container).

(3) Check that a DC supply of approximately 24 volts is present across Terminals 1 and 3 at the probe head (Terminal 1 positive). If not, check the same at the module (Pins 1 and 11 on the FLT.1R, Pins 1 and 6 on the FLT.2R).

(4) Check the voltage between the head of the posidrive screw in the centre of the probe head insert and earth. This should be approximately 4 volts DC.

(5) Recheck probe head setting as given under "Probe Head Adjustment" and then the relevant commissioning instructions.



Link C and H sets Fail-Safe High level.
Link C and L sets Fail-Safe Low level.

(3) For future reference it is advisable to alter the label suffix letter to indicate the new Fail-Safe mode.

SENSITIVITY RANGE SELECTION

The probe head insert is fitted with three terminals marked A, B and C. These provide the means by which three separate sensitivity ranges can be selected as follows:-

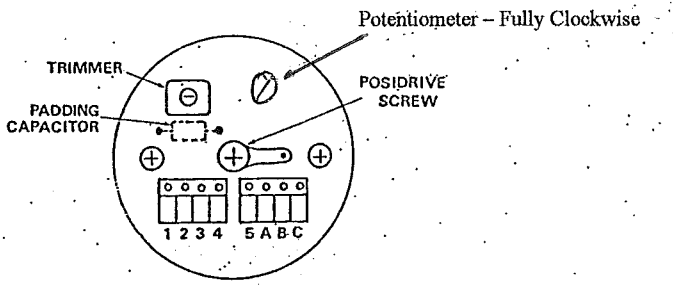
High Sensitivity (20 microamps/pf) – No link
Medium Sensitivity (7 microamps/pf) – Link A and B
Low Sensitivity (2.5 microamps/pf) – Link A and C.

Probes are normally despatched set for medium sensitivity (A and B linked via a short wire link) and for the majority of fixed point level control applications this range is perfectly satisfactory. For materials which have a very low di-electric constant and are difficult to detect it may be necessary to select the high sensitivity range. (No link fitted).

PROBE HEAD ADJUSTMENT

The probe head is fitted with an encapsulated capacitance – to current insert unit. Basically this unit detects the change in capacitance as material covers or leaves the probe and converts this into a current output. As will be seer from the diagram below this insert is fitted with an adjustable trimmer capacitor and in some cases also a fixed padding capacitor wired across two tags just below the trimmer. When the probe is fitted into the container the normal standing capacitance of the container will cause the output from the insert to rise i.e. in effect the probe 'sees' the standing capacitance of the container as 'material' and starts to give an output. The trimmer capacitor enables this standing capacitance to be offset and the output brought down to zero. On all probes this trimmer is preset before despatch so that the normal standing capacitance when the probe is fitted is automatically offset.

If, however, the probe rods are modified in any way, the probes are mounted close to the side of the container or there is build-up on the probes it may be found necessary to re-adjust the trimmer to offset a larger (or smaller) standing capacitance. This should be done only if the normal setting-up sequence fails to obtain satisfactory operation or if build-up on the probes gives false alarm signals at a later date.



The procedure for checking and re-adjusting the probe insert is as follows:-

(1) Ensure the level of material is well clear of the probe. If build-up has occurred do not remove this from the probe.

(2) Disconnect the wire from Terminal 2 on the insert.

(3) Using a test meter with at least a 0 – 250 microamp range (1000 microamps = 1 milliamp) connect it across Terminals 2 and 3 on the insert with the POSITIVE lead on Terminal 2.

(4) A reading of between 10 – 15 microamps should be observed. If the reading is above or below these figures, adjust the trimmer to correct.

(5) The trimmer capacitor has a range of adjustment (100 pf) sufficient to cover most applications. If, however, the trimmer has insufficient adjustment to correct an abnormally high or low current reading it will be necessary to add extra or remove existing padding capacitors.

If the reading is too high add extra or fit a higher value padding capacitor. If the reading is too low remove or lower the value of the existing padding capacitor. As a guide to calculating the increase or decrease in value of the padding capacitor required divide the microamp reading being obtained by 7 and the answer is the capacitor value in picofarads.

(6) Placing a finger on the posidrive screw head in the centre of the insert (in effect touching the probe rod) should cause the output from the insert to rise to or near to 1 milliamp.