

IQ 1000



Westinghouse
IQ-1000

● Trip

Reset

● Alarm



Function

Value

● Run



● Program

Step Up



Raise

Help

Set Points

Step Down



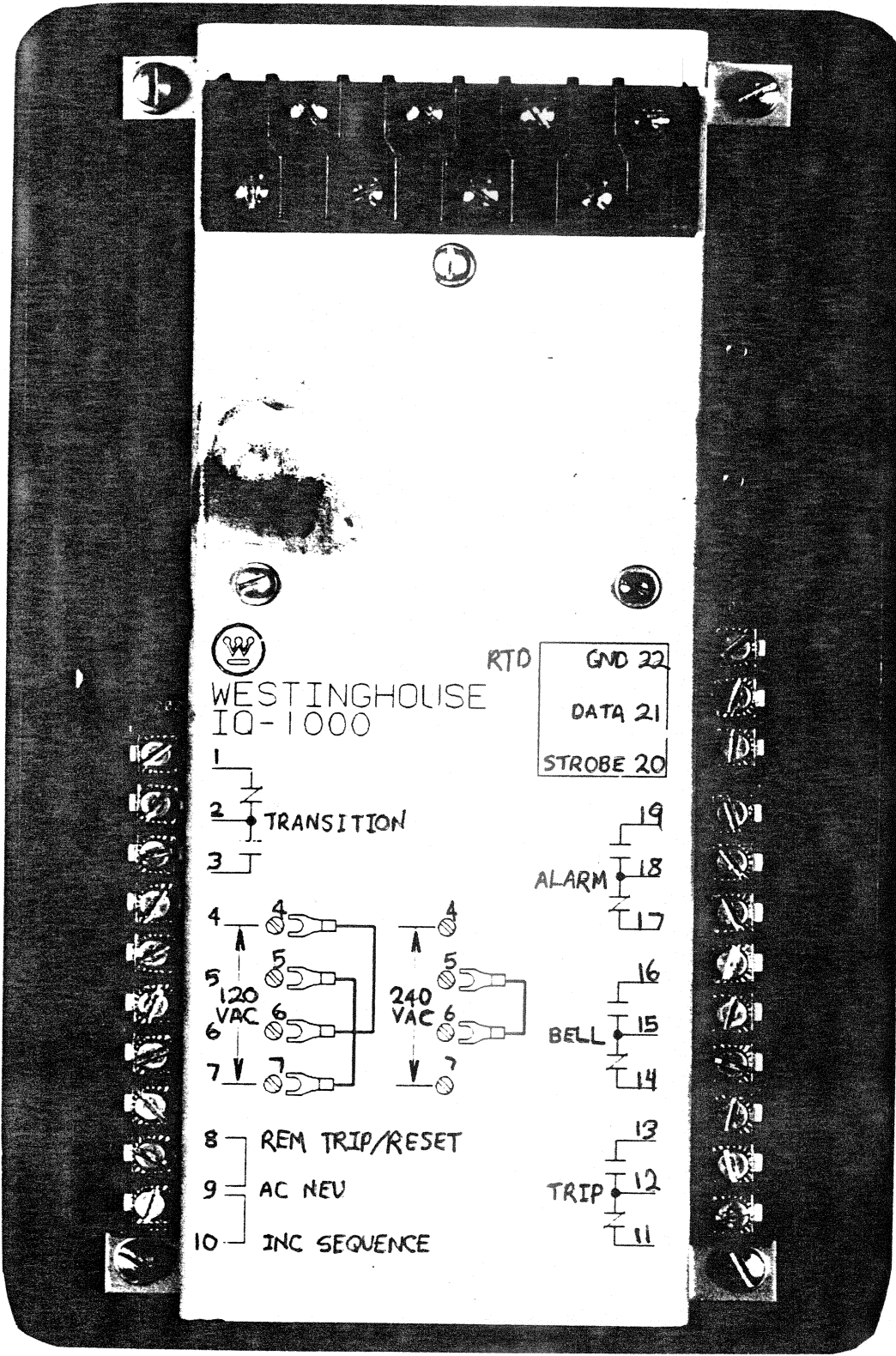
Step

Lower

CURRENT TRANSFORMER CONNECTIONS

COMMUNICATION CONNECTION

120/240
VOLT
CONTROL



REAR VIEW

IQ-1000

Following the success of the Westinghouse IQ-2000 Motor Command Module that allows maximum motor utilization, the Control Division recognized a need for a microprocessor with a primary function of motor protection only. Thus, the IQ-1000 was developed.

In addition, Westinghouse used this technology to develop a monitoring microprocessor unit called the IQ Data Plus. The IQ Data Plus functions from current and voltage input while the IQ1000 functions from current input only.

The IQ-1000 is a micro processor controlled, motor system that is available in a very small single integrated package which has the primary function of protecting AC motors. It also has metering functions.

The IQ-1000 has the same unique protective algorithm that is in the IQ-2000. It utilizes 3 phase motor current information and optional stator winding temperature data to protect both the stator and rotor from damage due to thermal overloads. The protection scheme utilizes the concept of positive and negative (unbalance) sequence currents calculated on a true RMS basis, coupled with digital thermal modeling, to predict rotor temperature and remove motor power before the thermal limits are exceeded. Ground fault basis of monitoring a zero sequence current transformer is also provided.

The monitoring features are:

- o AC amperes phase A
- o AC amperes phase B
- o AC amperes phase C
- o % full load amps phase A
- o % full load amps phase B
- o % full load amps phase C
- o Motor winding temperature
- o Motor bearing temperature
- o Load bearing temperature
- o Operation Count
- o Running Time
- o Remaining Starts
- o Motor Starts exceeded

The protective features utilize motor conditions such as current and temperature on an ongoing basis and first initiate an alarm condition, where appropriate, and finally a trip condition. These conditions perform the following functions:

- o Alarm condition energizes the alarm relay. Its contacts, terminals 17, 18, 19 are used external to the IQ1000 for control or reporting proposed.
- o Trip condition actuates a bell relay and trip relay. The contacts of the relays, terminals 11, 12, 13 and 14, 15, 16 are used external to the IQ1000 for controlling or reporting purposes.

When a trip condition occurs, the control stores the metering conditions prior to trip, such as motor current, temperature, etc.. This "picture" is maintained for use by maintenance personnel until the reset button is depressed.

The fault monitoring can be divided into the following groups or functions:

- o Load associated protection. The value of the motor current is used to detect Instantaneous overcurrent, Jam and Underload set point functions. Information from the load bearing RTD's compared with the set point values to initiate alarm and/or a trip condition. These set point functions are described in detail later in this text.
- o Rotor temperature protection. A motor current sensing scheme uses a separate current transformer for each of the three phases of AC line. A time base sampling allows instantaneous reading of motor current at numerous points in a given cycle. This is then converted to true RMS current. While sampling the AC line, both the positive (I1) and negative (I2) components of the motor current are calculated as follows:

$$I1 = \frac{IA + (IB + 120^\circ) + (IC + 240^\circ)}{3}$$

$$I2 = \frac{IA - (IB - 120^\circ) + (IC - 240^\circ)}{3}$$

$$I^2 = I1^2 + KI^2$$

The calculated values I1 and I2 are used by the protection functions for the rotor and stator temperature protection. The instantaneous overcurrent trips when the actual current exceeds the predetermined level.

The optional RTD module supplies information on the winding temperatures from up to 6 RTD's embedded in the stator winding of the motor. In addition, RTD'S is associated with the motor bearings and load bearings can also be monitored. The motor RTD's are used to supply information for input into the motor rotor protection algorithm and stator protection functions.

IQ1000 MONITORING AND PROTECTION FUNCTIONS

I. MONITORING DISPLAYS

1. IA - PHASE A CURRENT IN AMPS
2. IB - PHASE B CURRENT IN AMPS
3. IC - PHASE C CURRENT IN AMPS
4. %IA - PERCENT OF FULL LOAD CURRENT PHASE A
5. %IB - PERCENT OF FULL LOAD CURRENT PHASE B
6. %IC - PERCENT OF FULL LOAD CURRENT PHASE C
7. WT1 - WINDING TEMP 1 IN DEGREES C
8. WT2 - WINDING TEMP 2 IN DEGREES C
9. WT3 - WINDING TEMP 3 IN DEGREES C
10. WT4 - WINDING TEMP 4 IN DEGREES C
11. WT5 - WINDING TEMP 5 IN DEGREES C
12. WT6 - WINDING TEMP 6 IN DEGREES C
13. MBT1 - MOTORING BEARING TEMP 1 IN DEGREES C
14. MBT2 - MOTORING BEARING TEMP 2 IN DEGREES C
15. LBT1 - LOAD BEARING TEMP IN DEGREES C
16. LBT2 - LOAD BEARING TEMP IN DEGREES C
17. OCNT - OPERATIONS COUNT
18. RT - RUN TIME IN HOURS
19. RMST - REMAINING STARTS
20. OST - OLDEST START
21. STEX - ALLOWED STARTS EXCEEDED/WAIT IN MINUTES

II. PROGRAM DISPLAYS

NOTE: FOR EACH PARTICULAR DISPLAY, BY ACTUATING THE HELP PUSHBUTTONS, THE ENTERED MESSAGE IS SCROLLED ACROSS THE VIEWING WINDOW. EXAMPLE: GFRD - SCROLLED MESSAGE "GROUND FAULT RUN DELAY IN CYCLES". THERE IS NO NEED TO REFER TO A MANUAL.

1. S VER BO - FIRMWARE VERSION:
INDICATES THE PARTICULAR FIRMWARE SUPPLIED.
2. WDT - WINDING TEMP TRIP IN DEGREES C:
INDICATES THE TEMPERATURE AT WHICH ANY ONE OF THE STATOR WINDING RTD'S WILL CAUSE A TRIP. IQ1000 CONTINUOUSLY MONITORS ALL 6 WINDING RTD'S, IGNORING ANY SHORTENED OR OPEN RTD'S, AND TRIPS AT SET POINT (0 - 199°C).
3. MBT - MOTOR BEARING TEMP TRIP IN DEGREES C:
INDICATES THE TEMPERATURE AT WHICH EITHER ONE OF THE TWO MOTOR BEARING RTD'S WILL CAUSE A TRIP (0 - 199°C).
4. LBT - LOAD BEARING TEMP TRIP IN DEGREES C:
INDICATES THE TEMPERATURE AT WHICH EITHER ONE OF THE TWO LOAD BEARING RTD'S WILL CAUSE A TRIP (0 - 199°C).
5. WDA - WINDING TEMP ALARM LEVEL IN DEGREES C:
INDICATES THE TEMPERATURE AT WHICH AN ALARM OCCURS IF ANY ONE OF THE 6 RTD'S EXCEED SET POINT (0 - 199°C).
6. MBA - MOTOR BEARING TEMP ALARM IN DEGREES C:
INDICATES THE TEMPERATURE AT WHICH EITHER ONE OF THE TWO MOTOR BEARING RTD'S WILL CAUSE AN ALARM (0 - 199°C).

7. LBA-LOAD BEARING TEMP ALARM IN DEGREES C:
INDICATES TEMPERATURE AT WHICH EITHER ONE OF THE TWO LOAD BEARING RTD'S WILL CAUSE AN ALARM (0 - 199°C).
8. GF - GROUND FAULT TRIP LEVEL IN AMPS:
INDICATES THE AMPERES AT WHICH A TRIP WILL OCCUR (2 - 12 AMPS).
9. GFSD - GROUND FAULT START DELAY IN CYCLES:
ALLOWS A LOCK OUT TIME DURING START UP TO PREVENT NUISANCE GROUND FAULT TRIPPING (0 - 10 CYCLES).
10. GFRD - GROUND FAULT RUN DELAY IN CYCLES:
ALLOWS A TIME PERIOD OF 0 TO 10 CYCLES WHERE FAULT MUST PERSIST BEFORE UNIT WILL TRIP ON GROUND FAULT.
11. IOC - INSTANTANEOUS OVERCURRENT IN % FLA:
INDICATES THE INSTANTANEOUS TRIP VALUE IN % OF FULL LOAD AMPS ALLOWED (300% TO 1500%).
12. IOCS - INSTANTANEOUS OVERCURRENT START DELAY IN CYCLES:
ALLOWS A LOCKOUT TIME DURING STARTUP (0 - 10 CYCLES).
13. LRC - LOCK ROTOR CURRENT IN % FLA:
INPUT VALUE NEEDED FROM THE MOTOR MANUFACTURER FOR PROTECTION ALGORITHM CALCULATION.
14. LRT - MAXIMUM ALLOWABLE STALL TIME IN SECONDS:
INPUT VALUE NEEDED FROM MOTOR MANUFACTURER FOR PROTECTION ALGORITHM CALCULATION.
15. UTC - ULTIMATE TRIP CURRENT IN FLA:
INDICATES LOWEST POINT (LONGEST TIME, LOWEST CURRENT) ON MOTOR DAMAGE CURVE. THIS MEANS THAT IF MOTOR STAYS AT THIS LEVEL, TRIP WILL EVENTUALLY OCCUR. ONLY ACTIVE WHEN NO RTD'S ARE UTILIZED. ANY VALUE BELOW THE POINT WILL NOT CAUSE TRIP.
16. I2TA - I SQUARED ALARM LEVEL IN % I2T TRIP:
THE MAXIMUM THERMAL CAPABILITY ALLOWED TO THE MOTOR BEFORE ALARM AS DETERMINED BY THE SUMMATION POSITIVE AND NEGATIVE CURRENT SAMPLING (60 - 100%).
17. MAN RST-AUTO RST:
ALLOWS A CHOICE OF MANUAL RESET OR AUTOMATIC RESET.
18. JAM - JAM TRIP LEVEL IN % FLA:
INDICATES THE TRIP LEVEL ALLOWABLE WHEN MOTOR EXPERIENCES A TEMPORARY STALL CONDITION (70% TO 1200%).
19. JAMS - JAM START DELAY IN SECONDS:
ALLOWS A LOCK OUT TIME DURING START UP THAT PERMITS MOTOR TO ATTAIN FULL LOAD CONDITION BEFORE JAM FEATURE BECOMES EFFECTIVE (0 - 60 SEC).

20. JAMR - JAM RUN DELAY IN SECONDS:
ALLOWS A TIME DELAY PERIOD TO PERMIT THE STALL SITUATION TO CLEAR ITSELF BEFORE TRIP (0 - 240 SEC).
21. UL - UNDER LOAD TRIP LEVEL IN % FLA:
ALLOWS A MINIMUM TRIP VALUE IN % OF FULL LOAD AMPS (0 TO 90%) BEFORE TRIP. EXAMPLE WOULD BE A CONVEYOR SYSTEM WITH A BROKEN BELT OR A PUMPING SYSTEM WITH AN INTERRUPTION OF AFFLUENT.
22. ULSD - UNDER LOAD START DELAY IN SECONDS:
ALLOWS A LOCK-OUT TIME DURING STARTING TO PROVIDE TIME FOR THE MECHANICAL SYSTEM TO APPLY LOAD TO THE MOTOR (0 - 100 SEC).
23. ULRD - UNDER LOAD RUN DELAY IN SECONDS:
ALLOWS A TIME DELAY PERIOD TO PERMIT THE UNDERLOAD SITUATION TO CLEAR ITSELF BEFORE TRIP (0 - 240 SEC).
24. PU A - PHASE UNBALANCE ALARM LEVEL:
THE AMOUNT OF PHASE UNBALANCE ALLOWED BEFORE AN ALARM IS ACTUATED (10 - 50%).
25. PURD - PHASE UNBALANCE RUN DELAY IN SECONDS:
ALLOWS A TIME DELAY PERIOD TO PERMIT THE UNBALANCE SITUATION TO CLEAR ITSELF BEFORE ALARM (0 - 240 SEC).
26. 2 SEC - I2T TRIP - 2 SECOND DELAY OR I2T TRIP ON PHASE UNBALANCE:
ALLOWS THE TRIP CONDITION ON SINGLE PHASE TO BE 2 SECOND SAMPLING OR THERE IS THE OPTION TO WAIT FOR THE CALCULATED I2T TRIP.
27. ST/T - START PER TIME ALLOWED:
ALLOWS A SET NUMBER OF STARTS (1 - 10) IN A PARTICULAR TIME PERIOD. EXAMPLE WOULD BE 4 STARTS IN 2 HOURS.
28. T/ST - TIME ALLOWED FOR STARTS COUNT IN HOURS:
ALLOWS A TIME PERIOD (0 - 4 HRS) TO LIMIT THE NUMBER OF STARTS. THIS WOULD BE SET AT 2 FOR THE EXAMPLE SHOWN IN ITEM 22.
29. TRNC - MOTOR START TRANSITION CURRENT LEVEL IN % FLA:
ALLOWS A TRANSITION TO REDUCED VOLTAGE STARTING BASED ON % OF FULL LOAD CURRENT (50 - 150%).
30. TRNT - MOTOR START TRANSITION TIME IN SECONDS:
ALLOWS A TRANSITION TO REDUCED VOLTAGE STARTING BASED ON TIME (0 - 240 SEC) BACK UP TO CURRENT TRANSITION.
31. TRP TOUT - TRN TOUT - TRANSITION OR TRIP ON TIME OUT:
ALLOWS THE CHOICE OF TRANSITION OR SHUTDOWN ONCE THE TRANSITION TIME HAS ELAPSED.

32. INSQ - INCOMPLETE SEQUENCE REPORT BACK DELAY TIME:
 ALLOWS A SERIES OF EVENTS TO TAKE PLACE IN AN ADJUSTABLE
 TIME PERIOD (0 - 60 SEC). TIME INTERVAL MONITORED IS FROM
 TRANSITION TIME TO REPORT BACK. IF A REPORT IS NOT
 RECEIVED WITHIN THE TIME ALLOWED TRIP WILL OCCUR.
33. ABKS: ANTI-BACKSPIN DELAY TIME IN SECONDS.
34. FLA - FULL LOAD AMPS:
 INPUT VALUE NEEDED FROM THE MOTOR MANUFACTURER FOR ALGORITHM
 CALCULATION.
35. FREQ - FREQUENCY 60 HERTZ (1) - 50 HERTZ (0):
 ALLOWS THE CHOICE TO 50 HERTZ OR 60 HERTZ.
36. MODE 1 - MODE 2
 TRIP MODE 1 - TRIP RELAY ENERGIZES ON TRIP CONDITION.
 TRIP MODE 2 - TRIP RELAY ENERGIZES ON POWER UP AND
 DEENERGIZES ON TRIP CONDITION.
37. NON REV - REV
 ALLOWS THE CHOICE FOR A REVERSING OR A NON REVERSING
 STARTER SITUATION.
38. REM TRIP - REM RST
 ALLOWS THE CHOICE OF A REMOTE TRIP INPUT OR A REMOTE
 RESET INPUT TO TERMINAL BLOCK 8.
39. CTR - CT RATIO - N TURNS TO 1:
 THE PARTICULAR CURRENT TRANSFORMER USED TO FEED THE
 IQ2000 MUST BE PROGRAMMED. THE IQ1000 CAN ACCEPT A
 5 AMP INPUT. EXAMPLE: FOR A 600 TO 5 CT THE INPUT
 WOULD BE 120.

IQ-1000

BENEFITS TO CUSTOMER

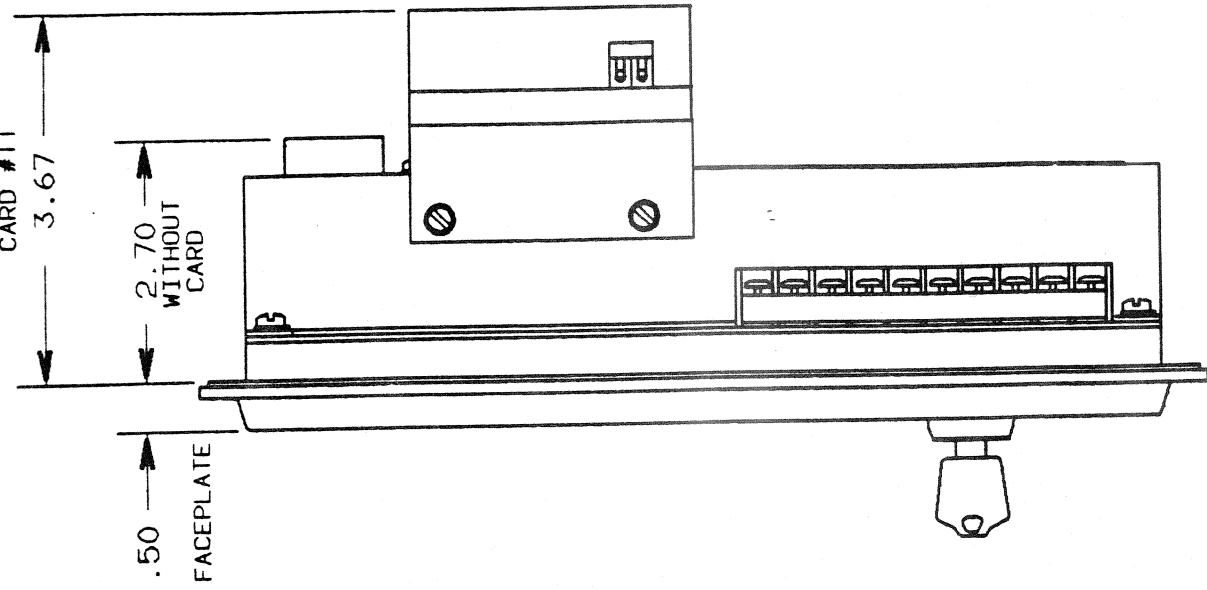
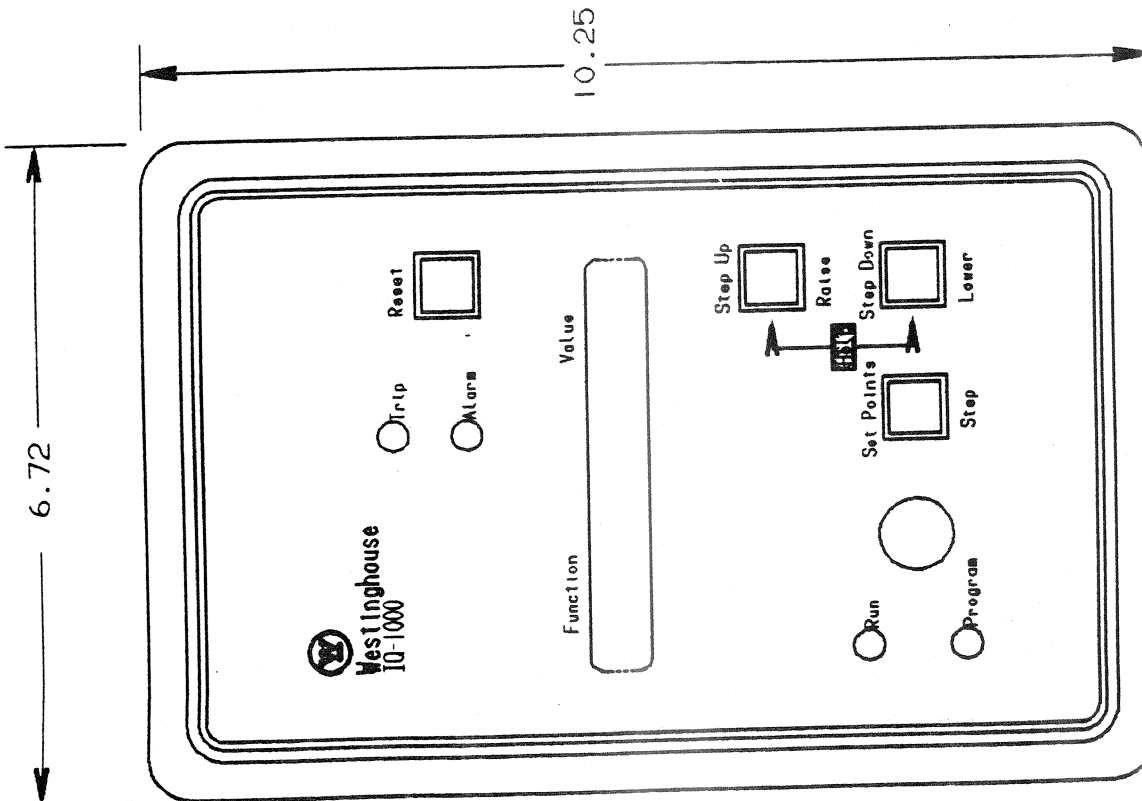
- o SPACE SAVINGS IN STRUCTURE
- o STANDARDIZATION OF DESIGN
- o USER FRIENDLY
- o ORDER SIMPLIFICATION - ONE STYLE NUMBER
- o POSITIVE AND NEGATIVE (UNBALANCE) SEQUENCE CURRENT SAMPLING
- o TRUE RMS
- o PROTECTION RELAYING INCLUDED
- o PROGRAMMABLE SET POINTS

- ±.02 UP THRU 30.00
- ±.05 ABOVE 30.00
- ±.006 ON HOLE DIA'S.
- ±1° MACHINED ANGLES
- ±2° FORMED ANGLES

Gr

Dwg. 7871A48

REVISION DATA



02

04

SHEETS

NO. 1

REV

01

SHEET

NO. 1

CADAM

DWG NO

7871A48

WRITTEN BY/DATE

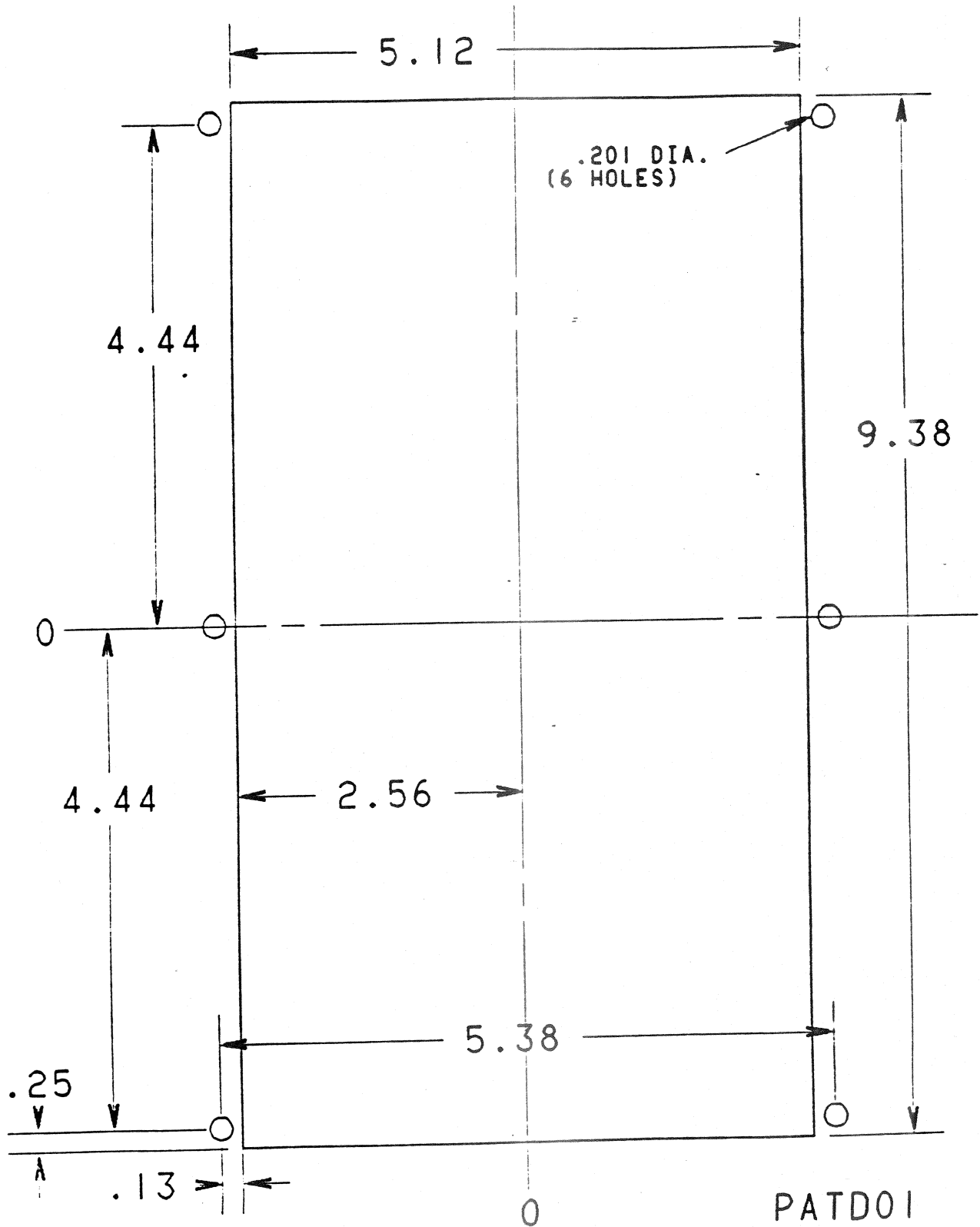
V. BROWN

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TITLE

IO 1000 OUTLINE

CADAM STANDARD LIBRARY



PATD01

DEVICE PANEL

DET NO. 1

TITLE

REV 03

DRAWING NUMBER

DRILLING PATTERN

PD.D