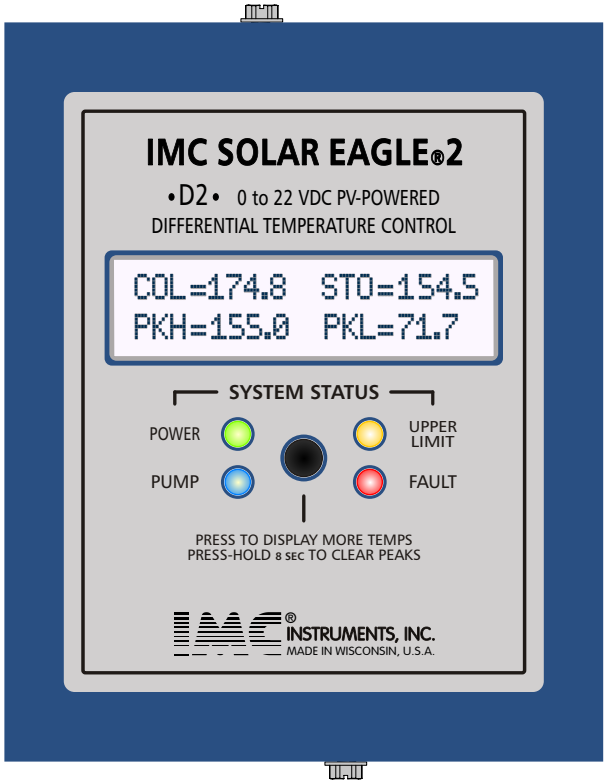
IMC SOLAR EAGLE®2 DIFFERENTIAL TEMPERATURE CONTROLLERS

MAIN FEATURES

- **PV POWERED from 0 VDC to 22 VDC** with ***smart*** power management at very low PV power levels, ***A must,*** for soft PUMP start & ***smooth*** controller operation.
- **Microprocessor** programed specifically for optimal performance of "DRAINBACK" systems*.
- **Large easy-to-read 40 character** (2x20) backlit LCD display showing every parameter measured and controlled by the onboard microprocessor.
- **With IMC's exclusive "DATA PORT"** designed for use with one of these optional devices:
  - REMOTE 4 LINE LCD DISPLAY
  - DATA ADAPTER TO PC'S RS-232
  - DATA ADAPTER TO PC'S USB
  - SD CARD RECORDER

  This unique transmitter allows these devices to be located up to 500 feet away connected with a conventional CAT-5 cable.
- **Solid State relay** that can handle up to 5 A for use with brushless DC or "soft start" motors. See specifications on pg. 3 for complete ratings.
- **Fault LED indicators** for simple diagnostics
- **Electrostatic** discharge protected electronics
- **Polyester coated 16 gage** rugged steel enclosure with features for efficient installation.
- **Reliable operation** when installed where the ambient swings do not exceed -10 to 120°F
- **Two industrial 400°F rated 10K thermistors with +/- 1°F accuracy** are included.
- **Auxiliary inputs** for two optional thermistors that can be located up to 1000 feet away.



SHOWN AT 5/8 SCALE

CONTROLLERS with 1/2" conduit holes for permanent wiring "hard wired":

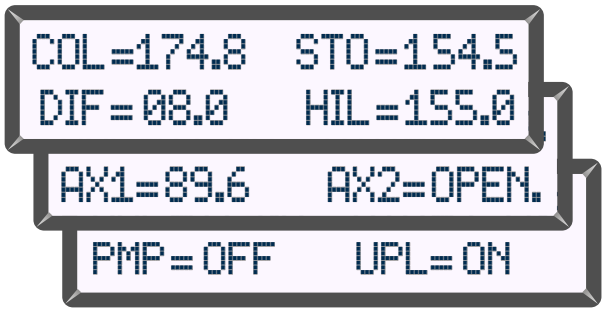
Product #
E2D2-0700-DB
with NON-isolated DATA PORT

LOCAL LCD DISPLAY

The LCD display has 2 lines of 20 characters each. The first line permanently displays the COLLECTOR and the STORAGE temperatures. The bottom line can be paged (switched) by pressing the black button. These pages display all system information* including OVERRIDE messages.

Page 1 is shown to the left.

Pages 2, 3 & 4 are shown below:

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* ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT
COL= COLLECTOR;  STO= STORED HOT WATER
PKH= WATER PEAK HIGH;  PKL= WATER PEAK LOW
DIF= DIFFERENTIAL; HIL= HIGH LIMIT(SETTINGS)
AX1; AX2= AUXILIARY SENSORS (OPTIONAL)
PMP= STATUS; UPL= WATER UPPER LIMIT (OFF/ON)
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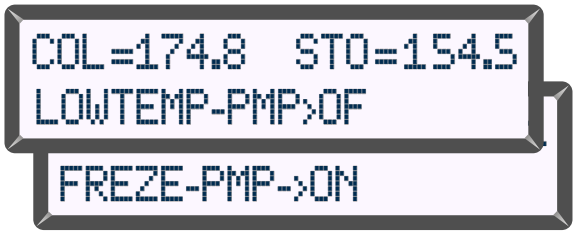
SYSTEM OVERRIDE MESSAGES FLASH on the LOWER LCD LINE are shown below:



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CONTROLLER OPERATION

TEMPERATURE DIFFERENCE CONTROL-

When the temperature difference between the sensor on the solar collector and the sensor in the storage tank exceeds the dialed temperature setting on “ON DIF”, the PUMP relay will actuate after a 30 second delay. The BLUE LED “RLY” indicator will also turn ON. When the storage tank temperature falls 4 degrees below the dialed setting on “ON DIF”, the PUMP relay and the BLUE LED indicator will turn off without delay. See “High Limit Control” below.

HIGH LIMIT CONTROL-

When the temperature in the storage tank exceeds the dialed setting on “HI LIM”, the PUMP relay will turn OFF without delay regardless of the temperature difference that exists between the STORAGE tank and the solar COLLECTOR. The BLUE LED indicator will turn OFF and the AMBER LED “ULT” indicator will turn ON. When the storage tank temperature falls 4 degrees below the dialed setting on “HI LIM”, the controller will resume normal operation. The PUMP relay will always have a 30 second delay before switching ON and the BLUE LED will always show its STATUS.

POWER & FAULT INDICATORS “LEDs”-

The GREEN LED “PWR” indicator is ON when the microprocessor is POWERED and the SOLAR controller is operating. The RED LED “FLT” indicator will be FLASHING when there is a FAULT condition. Faults occur when either storage or collector sensor is OPEN or missing, or if any sensor has resistance OUT of RANGE, or when the pump RELAY SWITCH is NOT set to “AUT” (automatic) position. It is also possible that an internal circuit malfunction initiates the FAULT condition.

LOW TEMPERATURE SHUT-DOWN OVERRIDE “LO”-

This feature is available to prevent a “drain back” water system from operating at low outdoor temperatures. If this feature is enabled, normal operation will stop when the COLLECTOR temperature falls below 50°F. The PUMP relay will then be turned OFF. Normal control operation will not resume until the COLLECTOR temperature returns to 70°F or above. To enable this feature, a jumper must be placed onto the pins marked “LO” on the circuit board. Only 1 override can be enabled.

OR

FREEZE PROTECTION OVERRIDE “FZ”-

This feature is available to prevent a “non-drain back” water system from freezing when the outdoor temperature drops too low. If this feature is enabled normal operation will stop when the COLLECTOR temperature falls below 40°F. The PUMP relay will then be turned ON until the COLLECTOR temperature reaches 55°F. Normal control operation will resume above this temperature. To enable this feature, a jumper must be placed onto the pins marked “FZ” on the circuit board. Only 1 override can be enabled.

DATA-PORT

This PORT transmits data ONLY, it is NOT bi-directional. The frequency at which the data transmissions occur is selected by the data refresh jumper labeled “2S 6M” on the circuit board (see drawing). Set jumper position to 2S for one complete line of “total system information” to be sent to the computer every 2 seconds, or set to 6M for 6 minutes. Complete instructions are supplied with accessories required to connect to a computer.
DO NOT CONNECT THIS PORT DIRECTLY TO ANY ETHERNET DEVICE OR COMPUTER PORT!

TYPICAL RANDOM SAMPLE DATA collected from PORT- (not all controllers output the same format)

```
RUNTIME  COLL-T   STOR-T   DIFF-T   HILI-T   AUX-1    AUX-2   PUMP  UPLim   FAULT              THESE COMMENTS ARE NOT TRANSMITTED
0:00      125.9    73.7     08.0     110.0    212.2    205.4    ON    OFF                       System collecting solar HEAT
0:06       25.9    73.7     08.0     110.0    212.2    205.4   OFF    OFF    LO-TMP->OFF        System in LO TEMP shut down PUMP->OFF
0:12       25.9    73.7     08.0     110.0    212.8    205.4    ON    OFF    PmpSW!             Pump switch ON
0:18    OPEN.S     73.9     08.0     110.0    212.8    205.4   OFF    OFF    SENS!, PmpSW!      Open sensor, pump switch OFF
0:24     -16.0     74.7     08.0     110.0     25.9    184.6    ON    OFF    FREZE-PMP->ON      System in Freeze protect mode PUMP->ON
0:30    SHRT.S     74.9     08.0     110.0     25.9    154.6   OFF    OFF                       Shorted sensor->System OFF
0:36      125.9   173.7     08.0     173.0    112.2     95.4   OFF    ON                        Storage reached UPPER LIMIT
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IMPORTANT NOTICE-

If a malfunction of an E2 series controller could cause personal injury or damage to equipment or property, other limit or safety controls, or alarm or supervisory systems, intended to warn and or protect against such occurrences must be incorporated into and maintained as part of the control system. This redundant built-in safety is required.

SPECIFICATIONS

Controller Power Input:
0.250 Watts @ 12 VD; **0 V min. to 22 VDC max.**
Warranty is VOID if voltage exceeds 22 VDC

Solid State Relay Ratings:
Normally Open- 5 amps DC motor @ 17vdc max
Use with **BRUSHLESS DC MOTORS ONLY!**

Relay Action:
30sec delay ON; no delay OFF

Differential:
Adjustable 8 to 24°F; fixed 4°F reset

High Limit:
Adjustable from 110 to 200°F

Accuracy: +/- 1 °F

Sensors:
10K @ 77°F (25°C) Rated to 400°F

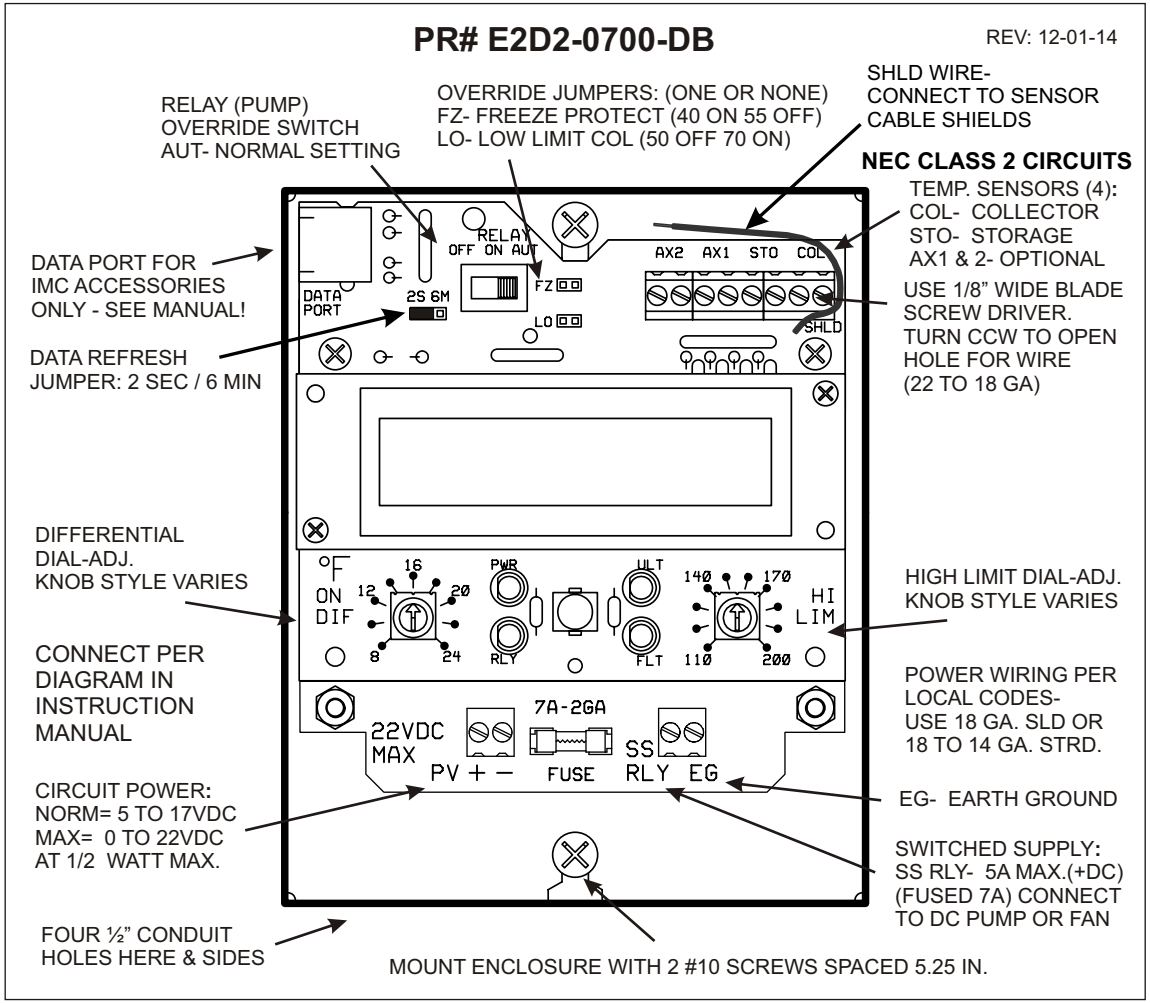
Environmental:
-10 to 120°F @ 0 to 95 %RH

Dimensions & Weight:
5.00”W x 6.12”H x 2.50”D; Appx. 2.0 lbs

SENSORS are Industrial grade 10K IMC thermistors rated for 400°F with +/-1°F accuracy. When installed properly, they will not exceed ONE degree of additional error for cable distances up to 1000 ft. of 18 ga., 700 ft. of 20 ga. or 500 ft. of 22 ga. Two “BOLT-ON” sensors are included with each controller (except -WA & -SP). See “Accessories” section for available probe types and sizes.

“BOLT-ON” sensors

NOTICE:
The DATA PORT’s “RJ-45” is NOT an ethernet or network connection!



5/8TH SCALE INTERNAL DRAWING WITH METAL
COVER AND H-V WIRING ACCESS COVER REMOVED

CONTROLLER INSTALLATION

MOUNTING- The Eagle line of SOLAR controllers are designed to be mounted indoors, protected from rain and condensing or dripping moisture. Overhead sensor wires may provide a path for dripping liquids, so form a “drip loop” before wire enters the enclosure opening. Use two #10 screws in the enclosure “keyholes” for mounting on a vertical wall with the two conduit holes facing down to the floor. After wiring and adjustments are done, replace the metal cover and tighten screws firmly.

SENSOR INSTALLATION AND WIRING- Sensor installation should be done in a manner as to permit proper sensor contact of the areas to be measured. Cover and/or insulate the sensors to prevent them from being affected by the surrounding ambient temperatures. Sensor wiring installed outdoors must be rated for OUTDOOR use. All connections exposed to the weather must be made with waterproof “outdoor rated” connectors. Today’s strong radio interference “RI” environment requires that all sensor wiring be shielded. Listed below are a few suggested cable/wire part numbers. Any other cable/wire selected must also meet local codes. Wiring exposed to outdoor weather must be rated for outdoor use by its manufacturer.

Minimum recommended specifications-	Better specifications-	Best specifications-
“Audio” Belden # 9451-10 Black (22ga)	“PLTC” Belden # 9322 (22ga) or 9320 (20ga)	“PLTC” Belden # 9322 (22ga) or 9320 (20ga)

The cable’s shielding wires must be connected to the green wire that is identified as “SHLD” on the cover’s backside label or the controller’s drawing on page 3. Connect all the shielding wires together with the “wire-nut” (supplied) or other reliable means. Ungrounded shields may result in damage to the Solar controller circuits. The shielding wires requires grounding at the controller side ONLY. DO NOT attempt to ground the collector panel with this wiring.

SENSOR SCREW TERMINALS- There are 8 or 10 screws on a GREEN block labeled “TEMPERATURE SENSORS”- see drawing on page 3. These terminals accept solid or stranded wire 18 to 22 ga. These are low voltage NEC class 2 circuit connections. For efficient and reliable wire connections, strip 3/16” to 3/8” of insulation from an undamaged wire end. Use a strip tool that will not nick the conductors. If wire is solid, make sure that the tip is NOT deformed so that it will fit into the terminal hole easily. If the wire is stranded, make sure the strands are tightly twisted. Using a 1/8" (3mm) wide blade screwdriver, turn CCW to open the terminal hole fully. Then guide the wire into the terminal hole and hold while tightening (turn CW) the screw to clamp the wire. WARNING- If a 5/32" (4mm) wide screwdriver blade is used, the plastic ridge that retains the screws will be scraped off allowing them to fall out. DO NOT reverse the screw turning directions and place the wire outside the metal “cage” creating an unreliable connection. DO NOT slip off the screw and damage any circuit components. Inspect that ALL the strands are clamped in the terminal’s “cage”.

POWER AND RELAY TERMINALS- Access this compartment by removing the shielding cover located below the LED lamps. This model operates from 4.75 Vdc to 22 Vdc@ 250 milliwatt. Operation below 4.75 Vdc is prevented by the smart POWER MANAGER including initial PUMP startup until there is sufficient PV power for proper PUMP operation. Operation above 22 Vdc could damage the controller and will void the warranty. The SOLID STATE relay is rated for 5 amps continuous load and has a NORMALLY OPEN (N.O.) CONTACT with the LOW SIDE connected to the NEG PV. The PUMP is connected between the PV PLUS and the open RELAY terminal. (See suggested wiring diagram on last page)
Terminals require an 1/8" (3mm) wide blade screwdriver. Turn CCW to open the terminal hole. Then insert the wire end (3/8”) and tighten CW. These terminal connections are designed for 18 ga solid copper or 18 to 14 ga stranded copper. All wiring must be done in accordance with local codes. If three or more wires require a common connection, it should be done in accordance with accepted methods and may require additional space in a separate junction box. Avoid using solid wire thicker than 16 AWG, because the circuit board can be damaged when forcing the wires into the compartment.

Line or power wires should NOT be bundled with or placed in the same conduit with sensor or data cables.

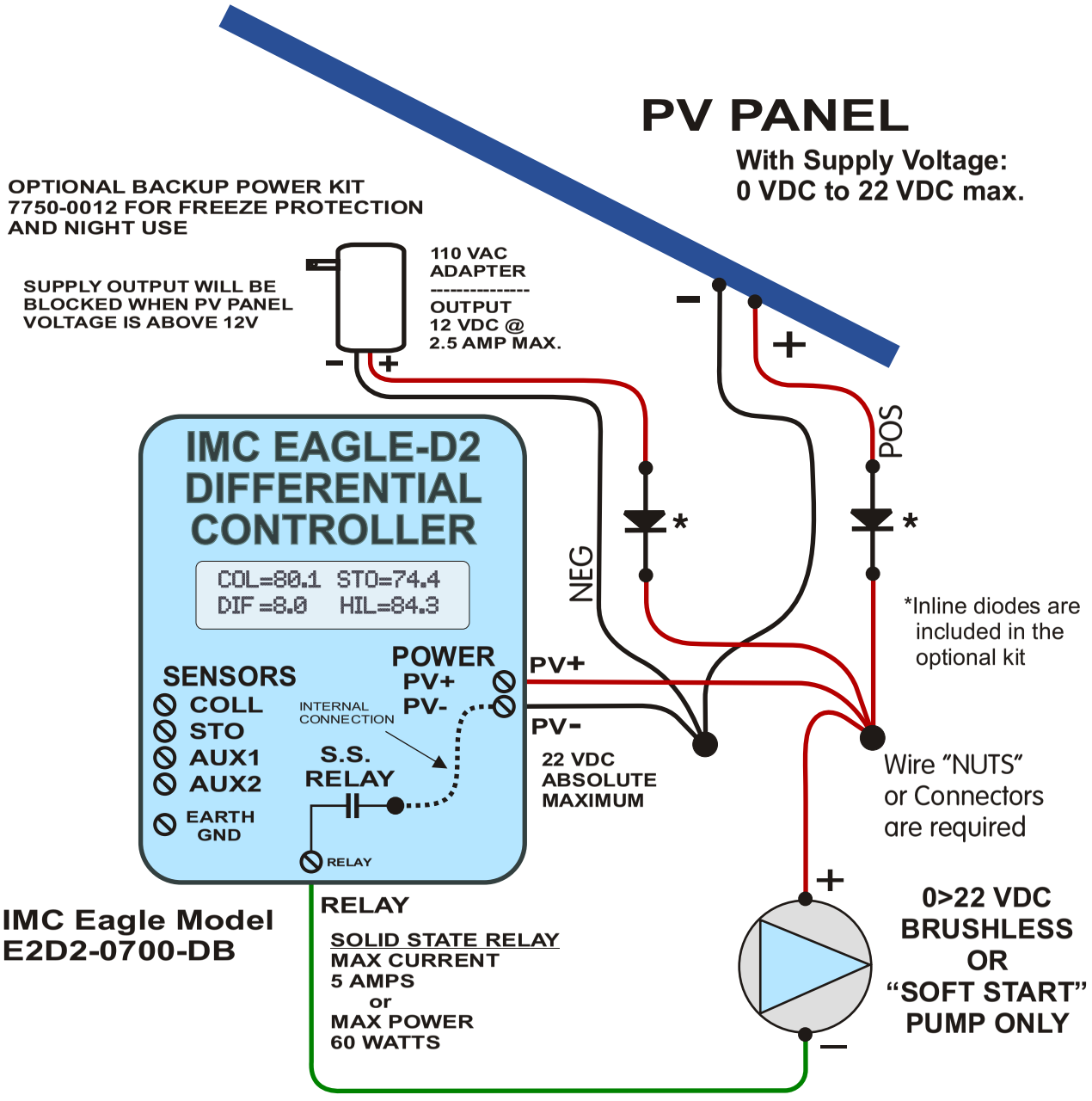
COLLECTOR GROUNDING- The Solar collector panel array must be GROUNDED directly to an earth ground rod. This is necessary to prevent damage from nearby lightening strikes which induce very DAMAGING high voltages in any ungrounded metal surface. Please consult local, state and federal codes for proper grounding. Please visit our website for news or recently released product information: **“www.solar.imcinstruments.com”.**

INSTRUMENTS, INC.

IMC SOLAR EAGLE®2

PR# E2D2-0700-BD

PV POWERED SOLAR HOT WATER SYSTEM



"NOTICE !! NEGATIVE SIDE SWITCHING"

REV. DATE 12-01-2014

INSTRUMENTATION WITH QUALITY ENGINEERING