PHASE 2 INSTRUMENTS
Broad Based
PROJECT LIST

Updated April 2014

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CAROUSEL 1

PHASE 2 INSTRUMENTS

PROJECT No	**F1**
PROJECT TITLE	**CONTROL LOOPS & INSTRUMENT SYSTEMS**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of Instrument Line Diagrams, and produce a series of usable Instrument Line Diagrams for future use

Prior to completing this assignment, you will need an example line diagram, to use as a template.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer

Task

- On the training Plant there are a variety of process measurement and control devices; flow, temperature, pressure, level, density and control valves.

- Select a device, making note of any reference numbers, then using a Digital Multi-Meter (DMM) carefully trace the signal connections of your chosen device taking note of termination numbers, cable numbers, junction boxes and any other components in the loop and their termination numbers.

- With this information produce an Instrument wiring loop diagram to the agreed format.

- The diagrams produced by the team, will be put together to produce a pack, that will be issued to all team members for use further in the program.

Task Feedback

- Produce a brief written report on the practical, and include the line diagrams you have produced.

PHASE 2 INSTRUMENTS

PROJECT No	**F2**
PROJECT TITLE	**CALIBRATION AND COMMISSIONING**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of Calibration and Commissioning techniques, used to determine the functionality of a process measurement / control loop

Prior to completing this assignment, you will need to have completed Instrument Line Diagrams from task F1.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

- You will be assigned a control/ measurement loop to work on, and you will be given instructions on what is required for this task.
- Obtain appropriate authorisation and Permit to Work.
- Obtain the calibration data (range)
- Using appropriate test equipment, perform a calibration check(s) on the instrument system, ensuring its calibration range matches that on the data sheet, and that any associated equipment indicate or operate correctly.

Task Feedback

- Produce a brief written report on the practical, and include a list of the calibration information for each device tested (before and after values) and include Permit(s).

PHASE 2 INSTRUMENTS

PROJECT No	**F3**
PROJECT TITLE	**FAULT FINDING**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of Fault Finding techniques, used to determine the functionality of a process measurement / control loop

Line diagrams from F1 may be useful for this task

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

- You will be assigned a control/ measurement loop to work on, and you will be given instructions on what is required for this task.
- Obtain appropriate authorisation and Permit to Work.
- Obtain relevant details for the system, ie: the calibration data (range)
- Using appropriate methods, identify and where possible rectify any fault(s) on the instrument system
- Complete a calibration report sheet for each component

Task Feedback

- Produce a brief written report on the practical, and include a copy of the calibration report.
- Break down/ identify the method(s) you used to solve this system fault
- Identify where information may be obtained to help you solve system faults you may encounter in the future
- Research the following methods of fault finding, and explain (with example) how these will help you in the future

1. Half Splitting
2. Function Block (Flow) Diagrams – (Yes/No)

PHASE 2 INSTRUMENTS

PROJECT No	**F4**
PROJECT TITLE	**INTRODUCTION TO SMART TECHNOLOGY**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain practical experience using SMART calibration equipment to determine the functionality of a process measurement / control loop

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

- You will be assigned a SMART control/ measurement loop to work on.
- Obtain appropriate authorisation and Permit to Work *(to complete the task below).*

1. Connect the “smart” communicator into the circuit as per manufacturers’ instructions.
2. Using appropriate keys on the communicator review, and note down, the data currently saved in the memory of the transmitter.
3. Identify from this data what the input limits of the transmitter are, its minimum range within those limits and its current calibration range.
4. Calibrate the transmitter using the values and confirm that the panel (DCS) readings are accurate
5. Change the range of the transmitter (to 2 x its current) using the keypad of the communicator
6. Re - check the calibration using the ‘original’ calibration range, and note the reading (effect) on the panel (DCS)
7. Return transmitter to original range settings using communicator.
8. Use the communicator to perform a “loop test”

- Return the system to normal

PROJECT F4 CONTINUED

Task Feedback

- Produce a brief written report on the practical, and include a copy of the calibration details.
- Identify (using diagrams) where in the control loop the communicator may be connected'
- Explain / summarise the differences (and benefits) with this method, over conventional methods of calibration

PHASE 2 INSTRUMENTS

PROJECT No	**H1**
PROJECT TITLE	**PROTECTION IDENTIFICATION**
R.O.A.SUBJECT AREA	**I-15 HAZARDOUS AREA EQUIPMENT**

Aim(s)

To investigate and gain a foundation level of understanding of, 'Hazardous Area Equipment', as used in Instrumentation.

Task

In this task you will investigate, and demonstrate understanding of:

1. The need for Hazardous area equipment, Legal obligations, Regulations.

2. The definition of a Hazardous Area, including what is meant by the terms:

    - Flashpoint
    - Auto – Ignition
    - Flammable Mixture
    - Lower Explosive Limit
    - Upper Explosive Limit

3. The classifications (zones) of Hazardous areas

4. Types of protection required for different hazardous conditions.

5. Gas groups and Temperature Classification

6. How Hazardous Area Equipment is identified and briefly explain the marking system, and to recognise equipment

7. The theories/ and difference(s) between Flameproof (Ex.d) and Intrinsically Safe (Ex ia/Ex ib).

8. Different items of equipment and provide evidence of its approved I.S markings.

9. Measures that can be taken to protect 'mains operated' equipment, ie: (Ex p)

10. What conditions, points need to be observed when using portable test equipment in hazardous areas.

Task Feedback

- Complete the written 'Hazardous Area Equipment' questionnaire.

PHASE 2 INSTRUMENTS

PROJECT No	**H2**
PROJECT TITLE	**FAULTFINDING on Hazardous Area Equipment**
R.O.A.SUBJECT AREA	**I-15 HAZARDOUS AREA EQUIPMENT**

Aim(s)

To investigate and identify 'Hazardous Area Equipment', as used in Instrumentation.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

In a given workshop / or work area:

1. Identify items of equipment which are I.S (Ex ia)
2. Identify items of equipment which are Ex.d (Flameproof)
3. Look for faults on given systems, and identify any faults you may find which compromise the protection.
4. Explain how the faults found can compromise protection

Task Feedback

- Produce a brief written report on the practical

CAROUSEL 2

PHASE 2 INSTRUMENTS

PROJECT No	**C1**
PROJECT TITLE	**PROCESS CONTROL THEORY and MODES OF CONTROL**
R.O.A.SUBJECT AREA	**I-17/18 MODES OF CONTROL**

Aim(s)

To gain understanding and knowledge of Process Control theory and the effects of the 3 main Modes of Control.

In this task, you will study the theory of Process Control, before using this knowledge to connect up, configure and tune a process controller and control system.

Task

In this task you will investigate, research, and be able to explain:

1. What is meant by Manual Control, and give examples of when 'manual' is used. What caution must be observed when in Manual.

2. What is meant by Automatic Control, and give example(s) of when 'Auto' is used.

3. What is meant by 'Feedback' and 'Feedforward' Control, and give example of how each affects control of the process and where each may be used.

4. How the control modes 'Proportional', Integral' and 'Derivative' take effect.

5. The terms, and relationship between 'Gain' and 'Proportional Band'

6. How more than 1 process variable may be used to control a process using 'Cascade' control.

7. Where and how 'Ratio' control may be used effectively in controlling process operation. Explain where you would use this method of controlling a process.

Task Feedback

- Produce a brief written report which covers each of the above

PHASE 2 INSTRUMENTS

PROJECT No	**C2**
PROJECT TITLE	**CONFIGURE A CONTROLLER**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how to configure or change parameters of a Process Controller.

In this task, you will access and modify process controller settings.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Familiarise yourself with the layout of an electronic controller, i.e. faceplate, terminations, controls and nameplate.

2. Connect up the power supply to the controller and switch on.

3. Using information from manufacturers user manual configure a Moore Mycro 352 electronic controller as a “single loop PID controller with Hi and Lo alarms and with tracking setpoint.

4. Using the configuration manual, find out how to:

    - Check the controller is a single loop PID controller (FCO1)
    - Move the position of the decimal point on the display, to show 2 decimal places.
    - Change the controller from direct to reverse mode. (leave the controller in reverse for task C3)
    - Ensure the output bar graph matches that of the control valve action
    - Access P.I.D settings
    - Set P to 100, I to 0.1 and D to 0
    - Place the controller to Auto, and set the Setpoint to 50%

Task Feedback

- Produce a brief written report for the above, include a copy of the configuration manual.

PHASE 2 INSTRUMENTS

PROJECT No	**C3**
PROJECT TITLE	**TUNING A PROCESS CONTROLLER**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how modes of control affect the behaviour of a Process Controller and the effects on the control system.

For this task, you will require a Moore 352 Process Controller.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. On the back of the Moore controller, connect terminal 4 to terminal 7 and connect terminal 5 to terminal 8, this connects the output to the input and will simulate a process. (*Note: Connecting the controller up in this way is for training/simulation purposes only*.) Check the controller is in reverse output mode, and setpoint is 50%.

2. Bring the process under control by:

    a. Checking Integral Action is 0.1
    b. Checking Derivative Action is 0
    c. Note the Proportional Gain is set to 100
    d. With the controller in “Auto” make a step change by moving the setpoint by about 10% in one swift movement
    e. Does the process come under control quickly? i.e. does the process move to a new position (not necessarily to the setpoint) and steady out at this new position?
    f. If not reduce the PG by half, and repeat this until the controller becomes steady.
    g. Once achieved set the Integral Action to 10 and make a step change.
    h. Does the process rapidly settle out at the setpoint?
    i. If not halve the Integral Action setting and until it does.
    j. This process is now under control and does not need Derivative Action.

3. Set Derivative Action to 10, make a small change to the setpoint, and note what happens to the process?

Task Feedback

- Produce a brief written report for the above.

PHASE 2 INSTRUMENTS

PROJECT No	**C4**
PROJECT TITLE	**CONSTRUCTING A CONTROL LOOP**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of where Process Controllers fit in a control loop.

In this task, you will connect up a process controller into a control system.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. You will be given a loop drawing (wiring diagram) from which you are required to wire up the associated control loop

2. Connect up the output side of the control loop first, put the controller on manual and stroke check the output.

3. Connect up the input side of the control loop and check that the (PV) indication on the process controller gives a value between 0 and 100%. (*Readings of -3.33 and above 103 indicate a wiring or connection fault*)

4. With the controller on Manual, set the controller indication to PV and Zero the transmitter to the controller.

5. Connect appropriate test equipment (loop calibrator/ milliamp source) to replace the transmitter

6. Put the controller on to Auto, and put the Set point to 50%

7. Adjust the test equipment output between 4 - 20mA noting how the control valve responds to the change in process value.

8. Using the configuration settings, ensure the controller has the right direct/reverse control action. If not, correct it.

9. Return the controller to Manual, and reconnect the transmitter.

Task Feedback

- Produce a brief written report for the above.

PHASE 2 INSTRUMENTS

PROJECT No	**C5**
PROJECT TITLE	**TUNING A PROCESS CONTROL SYSTEM**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how changing control modes, affects the behaviour of a Process control system. *For maximum benefit, This task follows on from Project C4*

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Start the process on manual and open the valve output to 50%. Then, Switch the controller to Auto, and set the setpoint to 50%

2. Make the following adjustments

    a. Set the Proportional Gain setting (SPG1) to 100
    b. Setting Integral Action to 0 (STI1) to 0.01
    c. Setting Derivative Action to 0 (SDI1) to 0.00

    Note the behaviour of the system

3. Adjust the Proportional Gain to 50%, and change the setpoint slightly and note the behaviour, and continue to reduce the Gain by halves, until the system begins to settle, and steady oscillation occurs.

4. Introduce Integral action via STI1, and set to 1, and then decrease this in halves. Noting the effect this has on the oscillation process value.

5. Continue making small adjustments of Gain and Integral until the process variable matches the setpoint. You should now be able to adjust the setpoint and the process will track it.

6. Now adjust the Derivative via STD1 to 1.00, and what effect do you note.

7. Reduce the derivative by halves, adjust the setpoint, and note the effects and keep doing this until the process behaviour settles

8. Make a note of the 3 values you have obtained.

Task Feedback

- Produce a brief written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**C6**
PROJECT TITLE	**TUNING A (multi variable) PROCESS CONTROL SYSTEM**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of 'Cascade Control' and how changing control modes affects the behaviour(s) of a Process control system. *For maximum benefit, This task follows on from Project C5*

You will require access to the Rig in workshop 9 for this task.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

Utilising the skills you have gained from Project C5, you are now going to use these to tune and control multiple process variables on a running plant. Please note that this control system has a cascade control loop, and you need to work out which is the primary and secondary controller.

1. Place all controllers to manual, and fully open each control valve.
2. Start the pump, and allow the process to stabilise.
3. Using the single loop controllers first, one controller at a time, switch the controller to Auto and tune it. (to a given value)
4. Using the same principle, now tune the cascade loop. Note the primary controller should be set as FCO1 and the secondary should FCO4
5. Ensure that All controllers can be left in Auto, with the plant running, and that changing the setpoint, will cause the controller to attempt to bring the process variable to the setpoint.
6. Make a note of the 4 sets of values you have obtained, then mess up the controller(s).

Task Feedback

- Produce a written report for the above, and include manufacturer data

PHASE 2 INSTRUMENTS

PROJECT No	**C7**
PROJECT TITLE	**USING DCS TO TUNE A PROCESS CONTROL SYSTEM**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain understanding of how changing control modes, affects the behaviour of a Process control system. How plant maintenance affects the control of a process plant

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. Risk Assessment and Permit are required for this task.*

- *You WILL need process authorisation to complete this task.*

Task

Plant/ Controller tuning

1. Start the process plant on manual, and bring the plant to a steady control state

2. You will be shown how to access the PID tuning parameters.

3. One loop at a time, Switch the controller to Auto, and loop tune, to accurately bring the system under control, to guidelines you will be given.

Plant Maintenance

For the following, you are required to carry out activities on the running plant, and the activity listed must be carried out so as NOT to shut the plant down.

4. You are required to carry out a carry out a transmitter calibration on an active control loop.

5. You are required to perform a stroke check on a control valve on a live system

Task Analysis

Produce a written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**D1**
PROJECT TITLE	**ARCHITECTURE OF DIGITAL CONTROL SYSTEMS**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain understanding, and BASIC knowledge of the architecture and design of Digital Control Systems.

Task

Using the DVD, 'Digital Control Techniques', research the following:

1. Six benefits/ advantages of using Digital Control systems
2. Explain what is meant by a 'control algorithm', and how this affects configuring a control system.
3. Briefly explain the following control systems, including positive and negatives:
    - DDC
    - Supervisory
    - DCS
    - PLC – Programmable Controllers
4. Using the internet, research and briefly explain the benefits of using 'smart' and 'Fieldbus' communication verses standard 4-20mA systems.
5. Go through the TTE Training Rig DeltaV induction package
6. Draw a diagram to identify the component parts of the TTE Training Rig DCS system.
7. What does the term I/O mean? Describe the I/O capacity of the TTE Rig DeltaV control system.

Task Feedback

- Produce a written report for the above,

PHASE 2 INSTRUMENTS

PROJECT No	**D2**
PROJECT TITLE	**DCS NAVIGATION – Operator View.**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain an understanding of the operating features of a typical DCS system.

You will require access to the TTE Control Rig for this task.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

Using the TTE DeltaV Navigation guide:

1. Log on to the DeltaV system in ‘Operator mode’
2. Load up the ‘Operator Interface’.
3. Select and navigate to a new control screen.
4. Open up an on screen controller, and switch it from auto to manual and back again. Also how to change the setpoint whilst the controller is in AUTO.
5. On the selected controller, display its configuration.
6. On the configuration screen, identify how Proportional, Integral and Derivative settings are accessed and changed.
7. Learn how alarms are displayed and how to accept alarms, and what the terms ‘LOW’, LOLO, HIGH and HIHI’ mean.
8. Learn how to access a trended output and change its time base

Task Feedback

- Produce a written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**D3**
PROJECT TITLE	**DCS NAVIGATION – Engineering Mode.**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain a basic level of understanding of the 'Engineering' features, of a typical DCS system.

In this project you will see how inputs to DCS are accessed and displayed

You will require access to the TTE Control Rig for this task.

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. You **MUST NOT** save any activity unless specifically told to do so.*
    - *You WILL need process authorisation to complete this task 8.*

Task

To begin this task, the DCS must be logged in, in Engineering Mode.

1. From the start menu, open 'DeltaV Explorer', identify what a 'NODE' is, and what this contains.

2. From the applications drop down menu, Locate and then describe what information is contained in the I/O configuration. Give examples of when this screen be useful?

3. Select an assigned module from NODE 1, right click on it, and view its Properties. What information is available here? *Do not change any of the settings and DO NOT save anything.*

4. Under 'Node1', in the I/O menu, open this, and what does this section allow you to do.?

5. Right Click on CO3, open the properties and what does this tell you?

6. Right Click in CH08 of CO3, what does this menu allow you to do

7. Load up, 'DeltaV graphics interface'. Open the file TTEV902. By copy/paste, add a Level indication to read the Level of Tank V902, using information from

the level control for that vessel. SAVE the screen, ensuring it is saved only as TTEV902.

PROJECT D3 CONTINUED

8. From the start menu, Open ‘Operator interface’, and open the screen TTEV902, note whether the indication you have created is reading. If So, perform a ‘Loop’ calibration using the ‘SMART’ communication handset.

9. Go back and DELETE the changes you have made, SAVE this.

10. Return to the Operator Interface, load up TTEV902 and check your work has been removed.

Task Feedback

- Produce a written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**D4**
PROJECT TITLE	**FAULT FINDING using DCS**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain experience of using a typical DCS system to solve instrument system related faults.

In this project you will see how inputs to DCS are accessed and displayed

You will require access to the TTE Control Rig for this task.

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. Risk Assessment and Permit are required for this task.*
    - *You WILL need process authorisation to complete this task.*

Task

You need to request a 'Control Loop' to work on:

1. Locate the 'data'/ 'wiring diagrams'/ 'I/O information' relating to the loop you have been given to work on.
2. Simulate an input to the DCS (at the DCS I/O rail) using appropriate test equipment and display the readings.
3. Make 25% step changes in the output from the DCS and monitor it using appropriate test equipment
4. Simulate an input to the DCS by calibrating the associated transmitter and display the readings
5. Make 25% step changes in the output from the DCS and monitor it using appropriate test equipment
6. From the DCS stroke check the associated valve.
7. Open the trend screen for this loop, and note the changes made

Task Feedback

- Produce a written report for the above, explaining how fault finding may be carried out using information from the screens.

PHASE 2 INSTRUMENTS

PROJECT No	**V1**
PROJECT TITLE	**REMOVE CONTROL VALVES**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in removing and refitting Control Valves to a Live Process Plant.

You will require access to the TTE Control Rig for this task.

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

You need to request a 'Control Loop' to work on:

1. Working in small teams, you will be allocated a control valve on the rig to work on.
2. Obtain as much information / technical information about the control loop and valve as available.
3. Prepare for valve removal, by Liaising with operators, have the control loop placed onto manual control, and any associated control valve bypass to be operated.
4. Isolate any air supplies, and then safely remove the valve from the rig. This procedure **MUST** take into account that the valve may be refitted by a third party who has no knowledge of valves, or the system.
5. Label the Valve**,** and provide any technical information with it to assist its refit,

Task Feedback

- Produce a written report for the above and include a copy of your Permit to Work.

PHASE 2 INSTRUMENTS

PROJECT No	**V2**
PROJECT TITLE	**VALVE OVERHAUL**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in overhauling Control Valves.

Practical to be carried out on two types of control valve

Health and Safety

- *Risk Assessment is required for this task.*

Task

You need to request a 'Control Valve' to work on:

1. Completely disassemble valve to component parts
2. Identify each component and their purpose
3. Check the condition of the parts, paying particular attention to the Plug/Seat.
4. Re-assemble valve, and ensure that the plug/seat are re-ground.
5. Calibrate or function check valve as appropriate
6. Check the valve to ensure it is NOT 'passing'.
7. Perform a leak check, and pressure test on the valve

Task Feedback

Produce a written report to include the following:-

- What would you do differently when overhauling Gland and Bellows seal valves, also between control valves and piston (spring assisted) shutdown valves
- Show by means of diagram how to incorporate a control valve and shutdown valve into a control/ shutdown system.
- Explain with graphical support, how Plug flow characteristics affect control
- Explain Direct / Reverse action,

PHASE 2 INSTRUMENTS

PROJECT No	**V3**
PROJECT TITLE	**STROKE CHECK**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in 'Stroke Checking' Control Valves in different situations.

Health and Safety

- *Risk Assessment is required for this task.*
- *Permit to Work and Process authorisation is required for Task 2*

Task 1

This practical may be carried out on from one of the valves from the previous practical's:

1. In pairs (small teams) stroke check a control valve using workshop test equipment, note down your findings and any corrective action taken

Task 2

2. Stroke check a control valve connected into a control loop using the DCS controller, note down your findings and any corrective action taken

3. Stroke check a control valve connected into a control loop using a mA source (loop calibrator) at the I to P, note down your findings and any corrective action taken

Task Feedback

- Produce a brief written report on the practical, comparing each of the methods
- A brief Valve testing procedure for on the bench and in-situ.
- What would you look for when testing a valve, and describe some of the common faults.

PHASE 2 INSTRUMENTS

PROJECT No	**V4**
PROJECT TITLE	**REFIT CONTROL VALVES**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in refitting a Control Valve to a Live Process Plant.

You will require access to the TTE Control Rig for this task.

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

You need to request a 'Control Loop' to work on:

Working in small teams, you will be allocated a control valve on the rig to work on.

1. Obtain as much information / technical information about the control loop and valve as available.
2. Prepare for valve refit, by Liaising with operators, ensure the control loop placed onto manual control, and any associated control valve bypass should be operated.
3. Safely reconnect the valve into the pipeline, ensuring the valve is in the correct way round, and the Air Fail Action of the valve supports this.
4. Reconnect the supply and signal, and De-Isolate.
5. Stroke check the valve
6. Check for leaks
7. Have operators re-commission the valve for service, remove any bypass and isolations.

Task Feedback

- Produce a brief written report on the practical

PHASE 2 INSTRUMENTS

PROJECT No	**V5**
PROJECT TITLE	**Valve applications and use**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience and understanding of the Range of control valve types

Health and Safety

- *Risk Assessment is required for this task.*

Task 1

1. Obtain a control valve with a ‘motion balance, ‘force balance’ and Digital valve positioner (DVC – Digital Valve Controller).
2. Investigate the differences in operation and application of 3 types of positioner.
3. Investigate the range of applications for the 3 valve types.
4. What factors affect the selection of a control valve
5. What are some of the benefits of using DVC’s.

Task 2

1. Obtain a range of Trip Valves
2. Investigate the operation of each Trip Valve
3. Identify particular hazards associated to Trip Valve Overhaul.

Task Feedback

- Produce a brief written report on the practical
- In what way are control valves different to Trip Valves

CAROUSEL 3

PHASE 2 INSTRUMENTS

PROJECT No	**H1 recap**
PROJECT TITLE	**PROTECTION IDENTIFICATION**
R.O.A.SUBJECT AREA	**I-15 HAZARDOUS AREA EQUIPMENT**

Aim(s)

Due to the critical nature of the environments you will be working in, this project is to re-focus your mind, into working in High Risk environments, and working with 'Hazardous Area Equipment', as used in Instrumentation.

Task

In this task you will revisit, and demonstrate understanding of:

1. Regulations relating to working in/ with Hazard Areas and Equipment.

2. The definition of a Hazardous Area, including what is meant by the terms:

    - Flashpoint
    - Auto – Ignition
    - Flammable Mixture
    - Lower Explosive Limit
    - Upper Explosive Limit

3. The classifications (zones) of Hazardous areas

4. Types of protection required for different hazardous conditions.

5. Gas groups and Temperature Classification

6. Recognising Hazardous Area Equipment

7. The theories/ and difference(s) between Flameproof (Ex.d) and Intrinsically Safe (Ex ia/Ex ib).

8. Different items of equipment and provide evidence of its approved I.S markings.

9. Measures that can be taken to protect 'mains operated' equipment, ie: E.M flow meter. (Ex p)

10. What conditions, points need to be observed when working on Hazard Area Equipment, and guidance when using portable test equipment in hazardous areas.

11. The 'ATEX' directive

PHASE 2 INSTRUMENTS

PROJECT No	**A1**
PROJECT TITLE	**ANALYSERS & SAMPLE SYSTEMS**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding through research, of a variety of commonly used 'on-stream' process analysers as used on a process plant.

Task

You will be shown two sample conditioner cabinets

Investigate the sample systems, then:

1. Produce a simplified diagram of each and Identify the component parts
2. Suggest what routine maintenance you might expect to carry out on them.

Task Feedback

- Produce brief write up to provide feedback on the above.

PHASE 2 INSTRUMENTS

PROJECT No	**A2**
PROJECT TITLE	**PRINCIPLES OF OPERATION**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding through research of the theory and application of a range of commonly used process analysers.

Using the 'Process Analysers' questionnaire, research the operation and uses of different types of process analyser

Task

1. Using course notes, manufacturers manuals, and the internet, investigate the principle of operation of the following analysers:-

   pH measurement
   Chromatography
   Oxygen (not dissolved oxygen).
   Liquid Conductivity
   Radiation Absorption
   Hygrometry
   Thermal Conductivity
   Liquid Density

2. Identify the component parts of each

Task Feedback

- Complete the 'Process Analysers' questionnaire.

PHASE 2 INSTRUMENTS

PROJECT No	**A3**
PROJECT TITLE	**pH**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding of the theory, and application of the measurement of pH.

Health and Safety

- Read through the project and produce a written risk assessment.

Task

1. Familiarise yourself with the portable pH meter.
2. Carry out a Buffer check on the meter.
3. Take a sample of water from the outside training rig.
4. Use the meter to check the pH of your training rig water sample and tabulate your results.
5. Based on the outside training rig, design an appropriate installation with process line diagram, which would allow for the continuous measurement of pH of a flowing product. (note: the pH meter will need to be removed for routine buffer checks).

Task Feedback

- Produce a brief written report on the practical, including your design
- Explain why you chose this location
- Write a simple flow diagram or procedure for carrying out a buffer check on the system you have designed.

PHASE 2 INSTRUMENTS

PROJECT No	**A4**
PROJECT TITLE	**CHROMATOGRAPHY**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding through research of the theory and application of Chromatography analysers.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Identify the component parts of the analyser

2. Research the operation of each of the component parts

Task Feedback

- Produce a brief written report

PHASE 2 INSTRUMENTS

PROJECT No	**A5**
PROJECT TITLE	**LIQUID CONDUCTIVITY**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding of the theory, and application of the measurement of Liquid Conductivity.

Health and Safety

- Read through the project and produce a written risk assessment.

Task

1. Familiarise yourself with the location of the Rig Liquid Conductivity meter.
2. Check the reading on the Conductivity meter local indicator, and also on the DCS screen.
3. Take a sample of water from the outside training rig.
4. Use a laboratory meter to check the Conductivity of your training rig water sample.
5. Tabulate your results Lab verses Onstream.
6. Based on the current training rig system, suggest a modified design for installation which would allow for the continuous measurement of conductivity of a flowing product. (note: the meter will need to be removed for routine checks).

Task Feedback

- Produce a brief written report on the practical, complete with results table, and including your design

PHASE 2 INSTRUMENTS

PROJECT No	**S1B**
PROJECT TITLE	**SHUTDOWN SYSTEM DESIGN using RELAY LOGIC (1)**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain understanding of design, fault finding and testing of Plant Shutdown/ Trip systems.

Health and Safety

- *Risk Assessment is required for this task.*

Task

1. You are required to draw/ design a 1 out of 2 trip system, using relay logic. The diagram must be a full ladder diagram, and ALL contact connections etc must be drawn. The system must include:

    - Manual Reset
    - Visible Indication of the output when the system has tripped.
    - Ability to test the system without impacting on the plant
    - The system has 2 x 8pin relays and 1 x 11 pin relay
    - 2 inputs (*using 2 pressure switches one on rising alarm, and one on falling alarm)*
    - 1 output (*for this part the output is a lamp*)

2. Your completed design must be checked, and once accepted, construct the complete shutdown/ alarm system you have designed, on the bench including all unit switches, and input / output devices.

3. Once your Trip System is fully functional and tested, incorporate a solenoid valve and trip valve, to demonstrate complete operation of the system(*this MUST be shown fully functional to the TO)*

4. Once fully tested, Change one of the inputs to show how a *Trip Amplifier, Alarm Gauge, and Level Switch* may be used as Trip Initiation devices

Task Analysis

- Produce a brief written report on the practical, and include your diagram(s)

PHASE 2 INSTRUMENTS

PROJECT No	**S2B**
PROJECT TITLE	**SHUTDOWN SYSTEM DESIGN using HIMA LOGIC**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience and basic understanding of HIMA LOGIC units, and how these are applied in the design of Plant Shutdown/ Trip systems.

Health and Safety

- *Risk Assessment is required for this task.*

Task

1. Investigate the basic design, and set up of a typical Solid State Shutdown System using a typical 'Hima logic' unit.

2. Trace all the inputs and outputs, and then complete the 'proformer' sheet to identify the input and output arrangement.

Task Analysis

- Explain the difference between relay and solid state logic systems (i.e.; how they operate)

- Give examples of how Hima Logic systems can be used for Plant interlock systems.

PHASE 2 INSTRUMENTS

PROJECT No	**S3B**
PROJECT TITLE	**INTRODUCTION to TRIP CHECKING PLANT SYSTEMS**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience in carrying out Shutdown/Trip system testing by following formalised Procedures

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

1. Obtain TRIP Check Procedure for the Trip units in workshop 9
2. Carry out Trip Checks in workshop 9, using the appropriate 'Trip Check Procedures' for the following systems:
    - Low Level
    - High Temperature
    - Low Flow
    - Low Pressure

Task Analysis

- Supply FULLY completed copies of each Trip Check procedure – these MUST be signed off by the T.O
- Risk Assessments and Permits to be supplied

PHASE 2 INSTRUMENTS

PROJECT No	**S4B**
PROJECT TITLE	**TRIP CHECKING on operating PLANT SYSTEMS**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience in carrying out Shutdown/Trip system testing by following formalised Procedures, on a running/ operational Plant

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*
- *Part of this task will require that the rig is running and checks are carried out live.*

Task

1. Obtain TRIP Check Procedures for the TTE Training Rig – 'Trip Systems'
2. Carry out Trip Checks using the above documentation:

Task Analysis

- Supply FULLY completed copies of each Trip Check procedure – these MUST be signed off by the T.O
- Risk Assessments and Permits to be supplied

PHASE 2 INSTRUMENTS

PROJECT No	**M1**
PROJECT TITLE	**RIG**
R.O.A.SUBJECT AREA	**I-22 MAINTENANCE PROCEDUREs**

Aim(s)

The purpose of this project is to **TEST** 'your' knowledge and ability under the pressure of working in a real life situation.

To gain an understanding, and appreciation of working as an instrument technician, to maintain a running process plant.

Under **NO** circumstances are you to cause improper plant shutdown.

Health and Safety

- Read through the project
- A written risk assessment and Permit will be required for **each** task, the Permit **MUST** be countersigned by your Training Officer.
- At NO point during the task are you allowed to leave the plant or items of equipment in an unsafe condition, or were ability to control the plant is compromised.
- You must FULLY liaise with plant operators during the tasks

Task

1. You will be given a variety of maintenance activities to carry out.

2. For each task you will need a permit, in order to get the permit you will undergo questioning from the operator in charge of the process plant.

   Tasks must be carried out in pairs. If it is your task, you must LEAD and carry out the task(s).

   You will need to understand what you will be doing during the maintenance task(s) and what consequence(s), if any, your actions may have on the control of the plant. Such consequences may be:- the effects of a control loop on Auto, bringing in a plant alarm, initiation of a plant trip, need for bypassing alarms or valves, or leakage of process media.

   You will need to tell the operator how such consequences may be minimised and managed.

   If the operator is not satisfied that you fully understand the job, you **will not** be issued with a permit.

PROJECT M1 Continued

3. You must follow any/all standard procedures while carrying out the task
4. You **MUST** report back to the operator on completion of each task.
5. All permits MUST be signed off on completion of the task(s)
6. A written maintenance report MUST be completed for each task and the maintenance log completed.

Task Feedback

- Produce a brief written report, detailing the tasks you have carried out. Include copies of ALL permits, data sheets etc that you have used during these tasks.