

MARKING CRITERIA AND STUDENT FEEDBACK

This section details the assessment criteria. The *extent* to which these are demonstrated by you determines your mark. The marks available for each criterion are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.

Common Assessment Criteria Applied	Marks available	Marks awarded
1. Research-informed Literature Extent of research and/or own reading; selection of credible sources; application of appropriate referencing conventions	10	4
SATISFACTORY. SEE GRADING CRITERIA		
2. Knowledge and Understanding of Subject Extent of knowledge and understanding of concepts and underlying principles associated with the discipline	25	15
VERY GOOD.		
3. Analysis Analysis, evaluation and synthesis; logic, argument and judgement; analytical reflection; organisation of ideas and evidence	25	12
SATISFACTORY.		
4. Practical Application and Deployment Deployment of methods, materials, tools and techniques; application of concepts; formulation of innovative and creative solutions to solve problems.	30	20
VERY GOOD.		
5. Skills for Professional Practice Attributes in professional practice: individual and collaborative working; deployment of appropriate media; presentation and organisation.	10	5
GOOD		

Assignment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)

Late Submission Penalties (tick if appropriate)

Up to four weeks late

First Attempt?

✓

56 %

FdSc & HN COMMON ASSESSMENT AND MARKING CRITERIA

Assessment Criteria	OUTRIGHT FAIL REFER (equivalent to 0-25%)	UNSATISFACTORY REFER (equivalent to 25-49%)	SATISFACTORY PASS (equivalent to 50-59%)	GOOD PASS (equivalent to 60-69%)	VERY GOOD MERIT (equivalent to 70-79%)	EXCELLENT DISTINCTION (equivalent to 80-89%)	EXCEPTIONAL DISTINCTION (equivalent to 90-100%)
1. Research-informed Literature Extent of research and/or own reading, selection of credible sources, application of appropriate referencing conventions	Little or no evidence of reading. Views and findings unsupported and non-authoritative. Referencing conventions largely ignored.	Poor evidence of reading and/or of reliance on inappropriate sources, and/or indiscriminate use of sources. Referencing conventions used inconsistently.	References to a limited range of mostly relevant sources. Some omissions and minor errors. Referencing conventions evident though not always applied consistently.	Inclusion of a range of research-informed literature, including sources retrieved independently. Referencing conventions mostly consistently applied.	Inclusion of a wide range of research-informed literature, including sources retrieved independently. Selection of relevant and credible sources. Very good use of referencing conventions, consistently applied.	A comprehensive range of research-informed literature embedded in the work. Excellent selection of relevant and credible sources. High-level referencing skills, consistently applied.	Outstanding knowledge of research-informed literature embedded in the work. Outstanding selection of relevant and credible sources. High-level referencing skills consistently and professionally applied.
2. Knowledge and Understanding of Subject Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.	Major gaps in knowledge and understanding of material at this level. Substantial inaccuracies.	Gaps in knowledge, with only superficial understanding. Some significant inaccuracies.	Evidence of basic knowledge and understanding of the relevant concepts and underlying principles.	Knowledge is accurate with a good understanding of the field of study.	Knowledge is extensive. Exhibits understanding of the breadth and depth of established views.	Excellent knowledge and understanding of the main concepts and key theories. Clear awareness of challenges to established views and the limitations of the knowledge base.	Highly detailed knowledge and understanding of the main theories/concepts, and a critical awareness of the ambiguities and limitations of knowledge.
3. Analysis Analysis, evaluation and synthesis; logic, argument and judgement; analytical reflection; organisation of ideas and evidence	Unsubstantiated generalisations, made without use of any credible evidence. Lack of logic, leading to unsupportable/missing conclusions. Lack of any attempt to analyse, synthesise or evaluate.	Some evidence of analytical intellectual skills, but for the most part descriptive. Ideas/findings sometimes illogical and contradictory. Generalised statements made with scant evidence. Conclusions lack relevance.	Evidence of some logical, analytical thinking and some attempts to synthesise, albeit with some weaknesses. Some evidence to support findings/views, but evidence not consistently interpreted. Some relevant conclusions and recommendations, where relevant	Evidence of some logical, analytical thinking and synthesis. Can analyse new and/or abstract data and situations without guidance. An emerging awareness of different stances and ability to use evidence to support the argument. Valid conclusions and recommendations, where relevant	Sound, logical, analytical thinking; synthesis and evaluation. Ability to devise and sustain persuasive arguments, and to review the reliability, validity & significance of evidence. Ability to communicate ideas and evidence accurately and convincingly. Sound, convincing conclusions / recommendations.	Thoroughly logical work, supported by evaluated evidence. High quality analysis, developed independently or through effective collaboration. Ability to investigate contradictory information and identify reasons for contradictions. Strong, persuasive, conclusions, justifiable recommendations.	Exceptional work; judiciously selected and evaluated evidence. Very high quality analysis, developed independently or through effective collaboration. Ability to investigate contradictory information and identify reasons for contradictions. Highly persuasive conclusions
4. Practical Application and Deployment Effective deployment of appropriate methods, materials, tools and techniques; extent of skill demonstrated in the application of concepts to a variety of processes and/or contexts; formulation of innovative and creative solutions to solve problems.	Limited or no use of methods, materials, tools and/or techniques. Little or no appreciation of the context of the application.	Rudimentary application of methods, materials, tools and/or techniques but without consideration and competence. Flawed appreciation of the context of the application.	An adequate awareness and mostly appropriate application of well-established methods, materials, tools and/or techniques. Basic appreciation of the context of the application.	A good and appropriate application of standard methods, materials, tools and/or techniques. Good appreciation of the context of the application, with some use of examples, where relevant.	A very good application of a range of methods, materials, tools and/or techniques. Very good consideration of the context of the application, with perceptive use of examples, where relevant. Evidence of some innovation and creativity.	An advanced application of a range of methods, materials, tools and/or techniques. The context of the application is well considered, with extensive use of relevant examples. Application and deployment extend beyond established conventions. Innovation and creativity evident throughout.	Outstanding levels of application and deployment skills. Assimilation and development of cutting edge processes and techniques.
5. Skills for Professional Practice Demonstrates attributes expected in professional practice including: individual initiative and collaborative working; deployment of appropriate media to communicate (including written and oral); clarity and effectiveness in presentation and organisation.	Communication media is inappropriate or misapplied. Little or no evidence of autonomy in the completion of tasks. Work is poorly structured and/or largely incoherent.	Media is poorly designed and/or not suitable for the audience. Poor independent or collaborative initiative. Work lacks structure, organisation, and/or coherence	Can communicate in a suitable format but with some room for improvement. Can work as part of a team, but with limited involvement in group activities. Work lacks coherence in places and could be better structured.	Can communicate effectively in a suitable format, but may have minor errors. Can work effectively as part of a team, with clear contribution to group activities. Mostly coherent work and is in a suitable structure.	Can communicate well, confidently and consistently in a suitable format. Can work very well as part of a team, with very good contribution to group activities. Work is coherent and fluent and is well structured and organised.	Can communicate professionally and, confidently in a suitable format. Can work professionally within a team, showing leadership skills as appropriate, managing conflict and meeting obligations. Work is coherent, very fluent and is presented professionally.	Can communicate with an exceptionally high level of professionalism. Can work exceptionally well and professionally within a team, showing advanced leadership skills. Work is exceptionally coherent, very fluent and is presented professionally.

Daniel Chick

Programmable Logic Controllers

Lecturer: Richard Wray

Assignment 1

Contents

Task 1: Programmable Logic Controller Types -	Page 3
Components Within a PLC -	Page 4
Task 2: Logic Diagrams And Truth Tables -	Page 5
Task 3: Timers and Counters -	Page 7
Task 4: Washing Machine -	Page 9
Task 4: Conveyor -	Page 11
Task 4: Detection Counter -	Page 13
Task 5: Traffic Light Programming Problem	Page 15
References	Page 18



Task 1: Programmable Logic Controller Types

A)

Unitary PLC

A unitary PLC is a basic controller that is designed for simple tasks where only one controller is required. The unitary PLC contains all the software and hardware required within the same unit, so no additional components are required to function. The components of a unitary PLC are typically a power supply, processor, memory and a varied number of input and output ports. The amount of ports vary depending on the price of the unit. The unitary PLC's can be added to by linking up other unitary systems and therefore expanding the capability of the processor. There is a limit on the amount of PLC's that can be linked and the information is usually specified by the manufacturer. *Not in this case.*

Unitary PLC's are mostly used on simple processes that require less inputs. Such a system could be a simply lighting circuit or program to fill up a boiler or water tank.

An issue with unitary PLC's is that they are a basic system can have limitations to the amount of expansion and processes they can handle. And if any changes are required, then a user would have to physically be connected to the PLC to access the processes.

If a system fails, then the whole unit will have to be replaced.

Modular PLC

Modular PLC's are PLC's that can be added or subtracted together to perform a variety of functions. A base unit is required, that has the basics such as a power supply and processor, but addition modules can have varying functions such as analogue to digital or just expand the amount of input and outputs. Disadvantages of modular PLC's are that they only contain one CPU and therefor can still only perform "one" task, and increases in the amount of modules, decreases the scan speed. Advantages are that they contain a huge number of inputs and outputs and varying functions, and are relatively cheap to purchase. A good application of use would be small manufacturing processes such as a small bakery. Communication cards can be added so the processes can be edited from elsewhere ✓

Rack Mounted PLC

A rack mounted PLC can be used for all sizes of processes but are more required where there are large scale manufacturing processes or large industry. Rack mounted are modular with each section fitting into the racking, the modules can be extra input or outputs, extra CPU's, power supplies and additional features, meaning this PLC can perform a variety of functions and processes and can perform several actions at once. If the process needs to be expanded, then addition cards can be easily added to compensate for the increase in processes or inputs/outputs. Communication cards can be added so the users can view or edit and processes from a control room or from anywhere in the world. Advantages of rack mounted is that if a section fails, it can be easily replaced. ✓

A disadvantage of rack mounted systems is that they are expensive to buy. ✓

B) Components Within A PLC

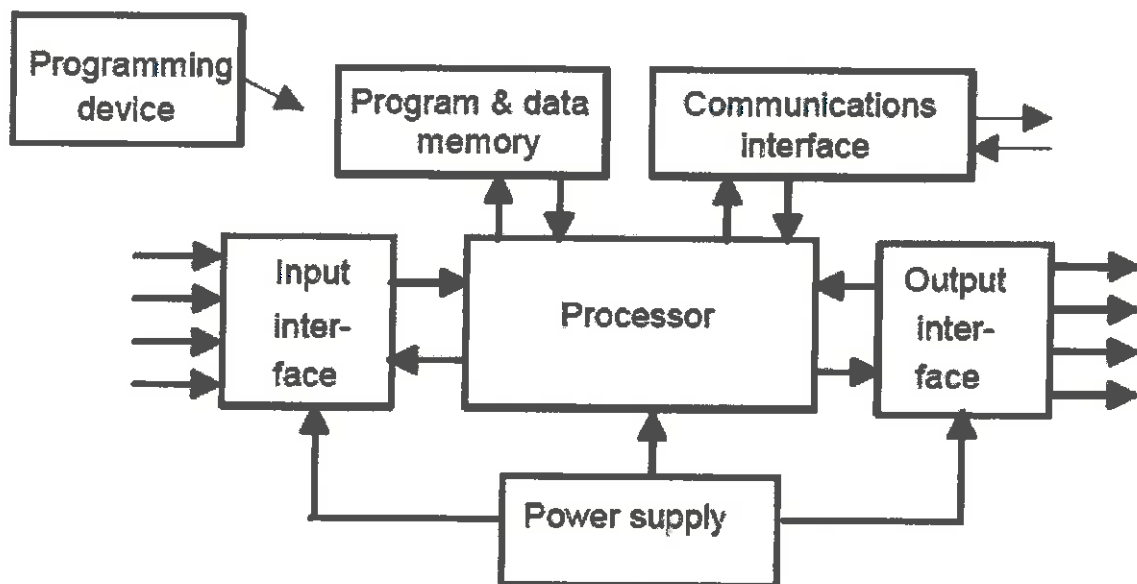


Image taken from "W.Bolton,(2006)Programmable Logic Controllers. 4th Edition"

A typical PLC contains 6 components that allow it to function.

The first is the CPU, this is the main component of the PLC and "decides" what to do with the incoming data and signal and sends out the appropriate output. The inputs and output come in as either a high or a low (1 or 0) and are sent out as a high or a low depending on functions stored within PLC.

The power supply; this takes the incoming power from a source. e.g 110v or 230v, and changes it to the required voltage for the PLC to function. It may also change the incoming power from A.C to D.C if required. It transmits its power to the processor, inputs, and the outputs and any other cards that require power e.g. communication cards.

The Program & data memory; this component is used to store all the data for the PLC to function, it will contain the basic software for the PLC to function, and will also store the program that is desired of the PLC. Some systems could have expandable memory or removable memory for the quick changing of programs to another PLC.

The Programming device is used to enter the program required into the PLC's memory.

The input and output sensors are used to receive data from various sources, such as sensors or switches, and send the data, once it's been through the program and gives the appropriate output, to other components, such as other electrical systems, LED's, gauges or displays.

The communication interface can send or receive signals from other PLC's to enable them to function, or work as a modular system. The communication interface can also be used to edit the program within the PLC if the PLC system will allow it.

Missing protective devices

Task 2: Logic Diagrams and Truth Tables

A)

AND Gate

INPUT A	INPUT B	OUTPUT
0	0	0
0	1	0
1	0	0
1	1	1

An output can only be achieved when both A and B are high.

OR Gate

INPUT A	INPUT B	OUTPUT
0	0	0
0	1	1
1	0	1
1	1	1

An output will be achieved when there is an input on A, or B, or Both.

NAND Gate

INPUT A	INPUT B	OUTPUT
0	0	1
0	1	1
1	0	1
1	1	0

This gate is the opposite of a AND gate and will give an output on all scenarios other than when both inputs are high.

NOR Gate

INPUT A	INPUT B	OUTPUT
0	0	1
0	1	0
1	0	0
1	1	0

NOR Gates give the opposite output to an OR gate.

XOR Gate

INPUT A	INPUT B	OUTPUT
0	0	0
0	1	1
1	0	1
1	1	0

An XOR gate gives an output when one or the other inputs are high, but not when both are high.

B) Logic Gate Circuit

INPUT A	INPUT B	INPUT C	OUTPUT
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

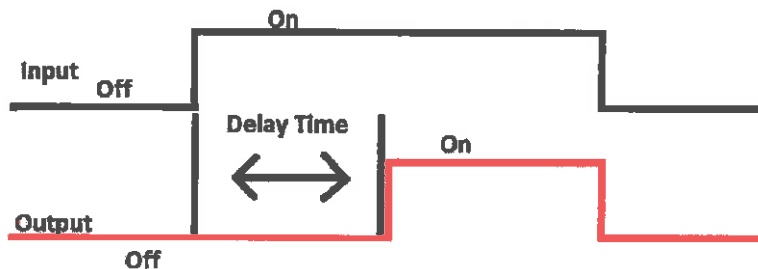
With this Logic gate circuit, when both B and C are high, they produce an output, by making A high, it does not change the outcome of the circuit. B has to be high along with either A or C to produce an output.

If this logic circuit was connected to safety guards, A being a moveable guard, B being a start button and C being another guard, The circuit would still function with A not in place and could pose as a hazard to personnel using the equipment.

Task 3: Timers and Counters

A)

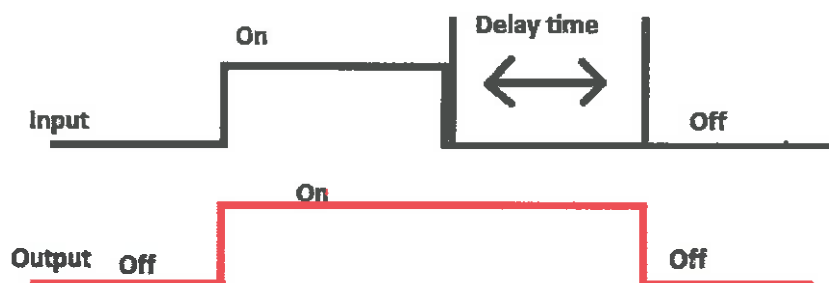
On-Delay Timer



An On-Delay Timer provides a delayed response time from when the timer receives a high signal input to giving an output, the time of the delay can be adjusted to suit the users need according.

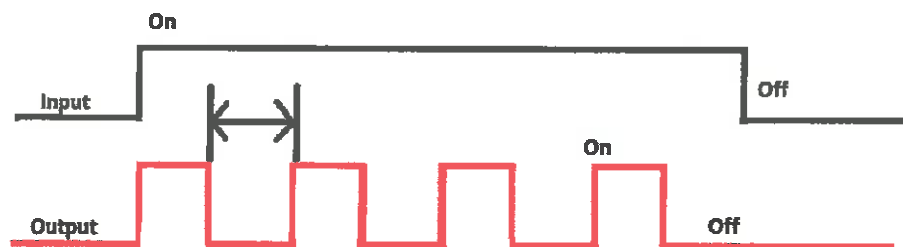
An issue with the on delay timer is that if the input signal goes low before the on delay time is reached, the timer will then not give an output.

Off-Delay Timer



An Off-Delay Timer provides a delayed off response to the incoming signal. The time will initially turn on when receives a high signal, but once the incoming high signal goes low, the timer will then count to a specified time before switching low.

Pulse Timer



A Pulse timer works that when the timer receives a signal, the timer will then turn high and low to a set frequency, as long as the incoming signal remains high, the timer will continue to pulse. This type of timer can be used to electronically count time if the frequency is set to a correct level.

B)

One of the types of counters used within the PLC systems is a UP Counter.

When the counter receives an incoming high signal, the count is increased by 1, they can be set to a certain level of counts, so that when that count is reached they provide an output high.

The counter can also be reset using the clear input of the counter, when this receives a high.

The counter is reset from X number, to zero.

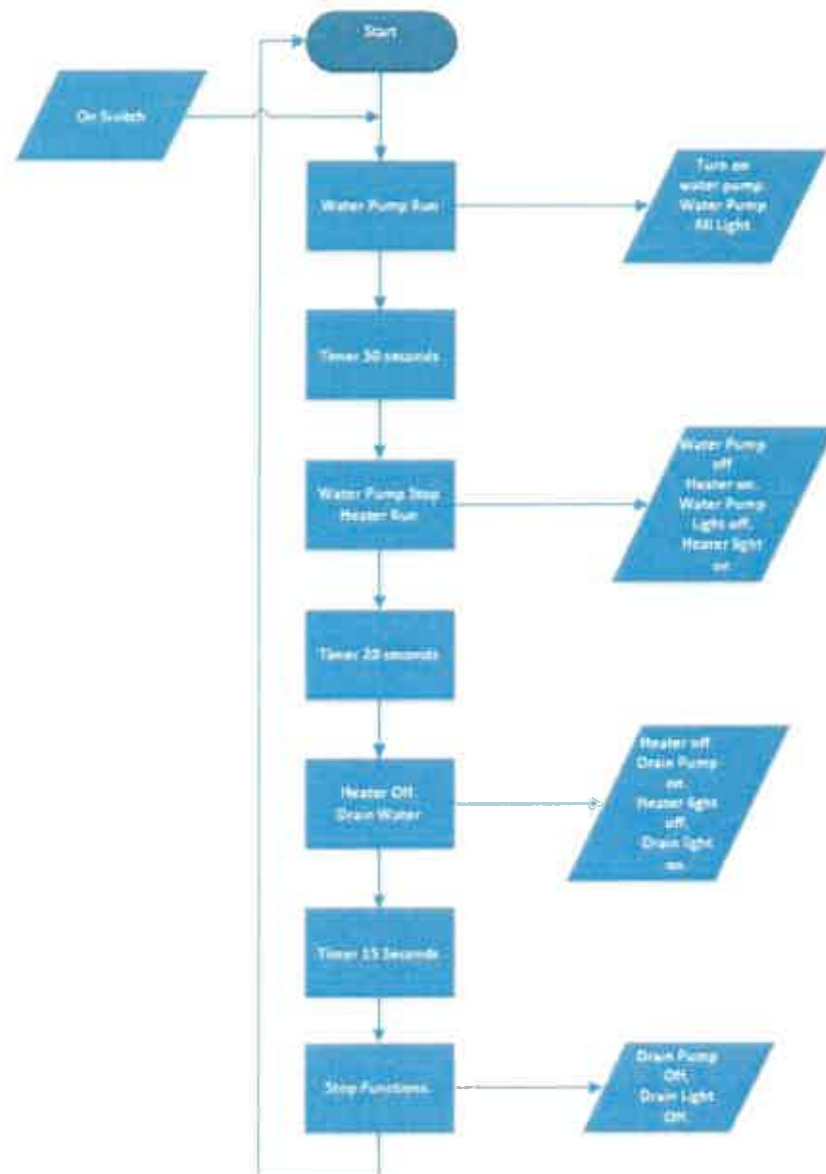
This system could be used to record the amount of people entering a shop.

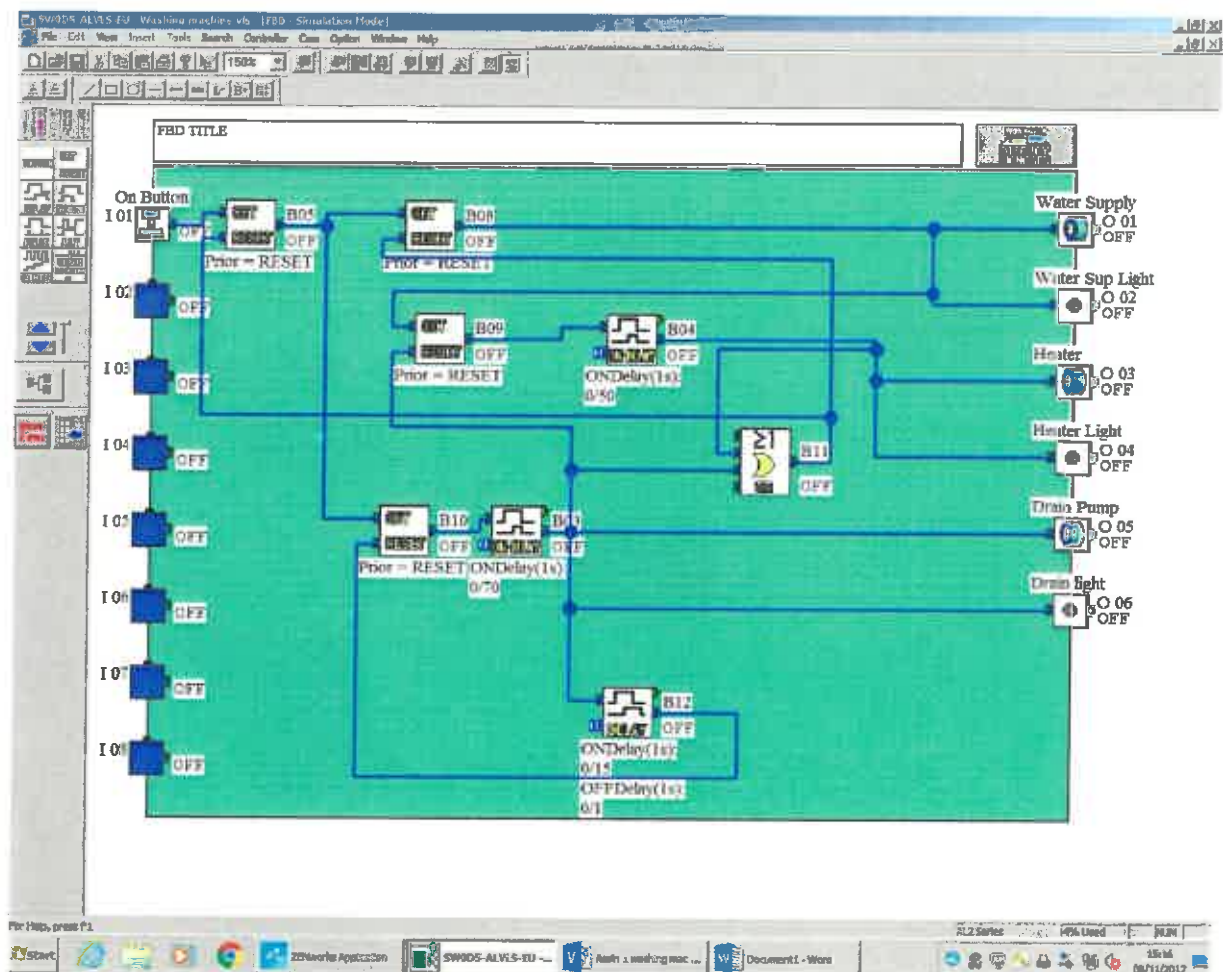
Another type of counter is the DOWN counter, this works in a similar way to the UP counter, but when the counter receives a input high, it decreases the count of a set value by 1.

This counter can also be reset back to its original value once the reset input receives a high.

This counter could be used in stock checking of a shop, that records the amount of one product being sold and warns if stock is low.

Task 4 Washing Machine





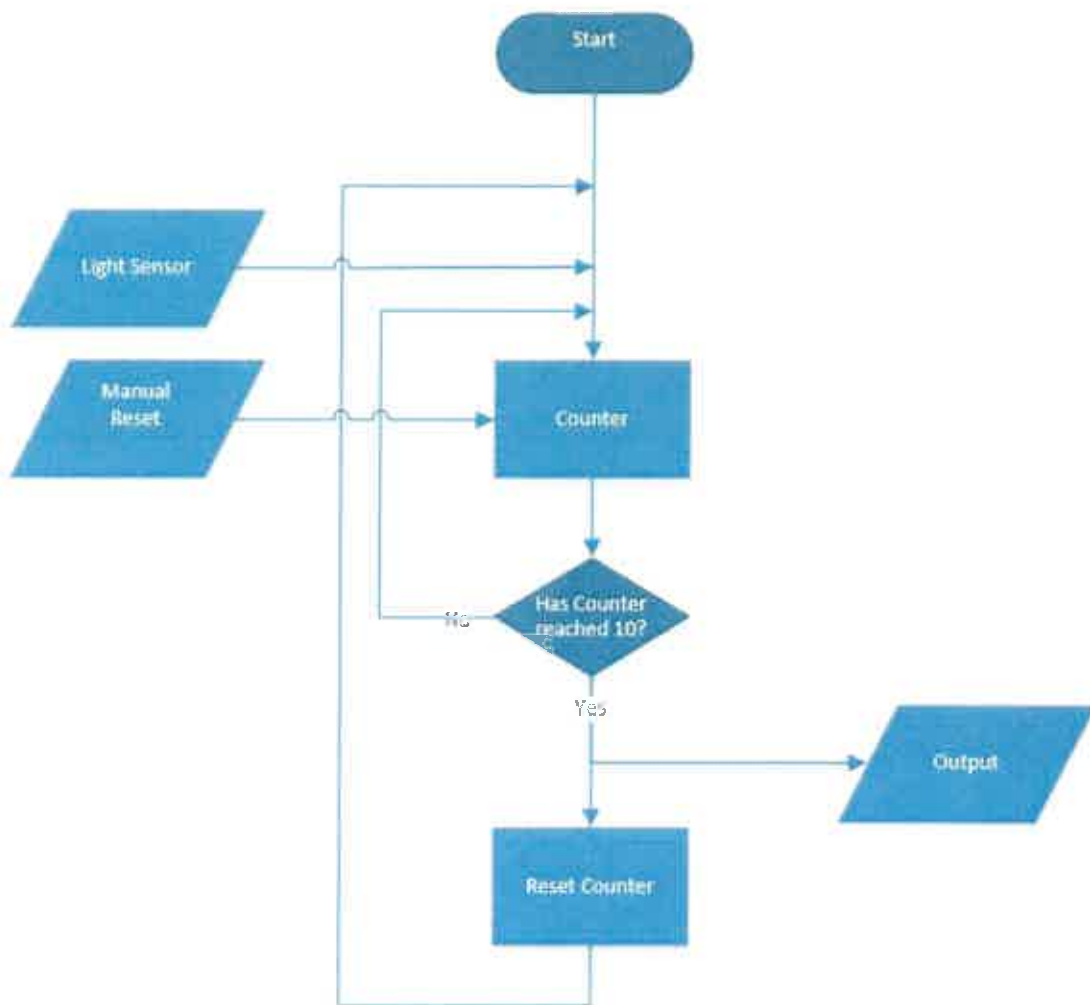
The task involved designing a washing machine program that was to pump in water, heated, and then drain. The cycles should run for a set period of time, run automatically and terminate the program itself. The program should activate lights for each sequence and extinguish the lights once the sequence has finished.

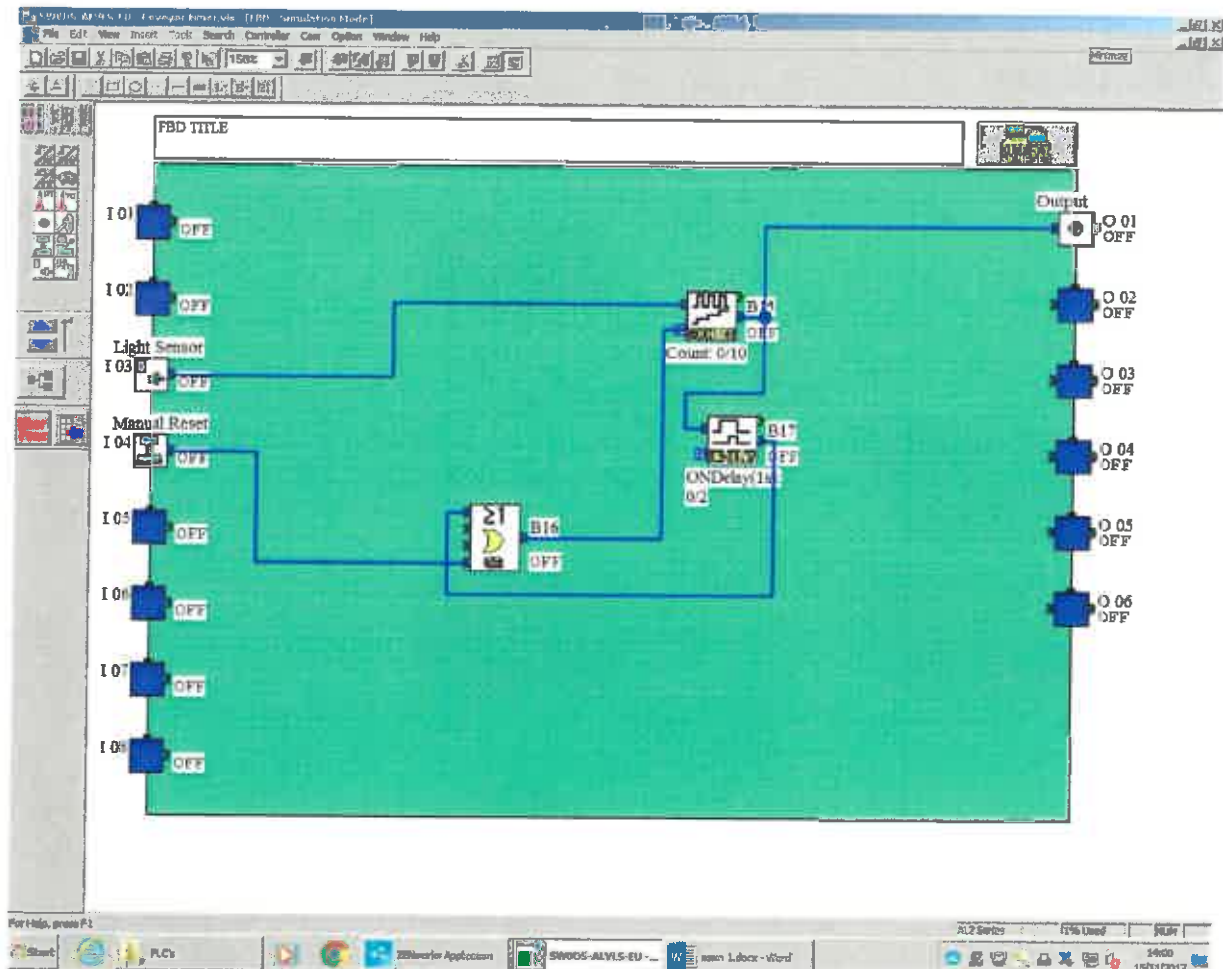
Identify The flowchart states the inputs and outputs of the program during each sequence, and also states the run time of each sequence and the automatic termination which then leads back to the start.

The PLC program starts with a push button that once pushed, will not be required to stay on as the 'SET/RESET' will then power the system until it is then reset, removing the high output.

Each cycle of the program then has its own 'SET/RESET' which is reset by the following sequence's ON-DELAY timer. The outputs are displayed by LED's for the indicator, and motors for the function of each sequence.

Task 4 Conveyor



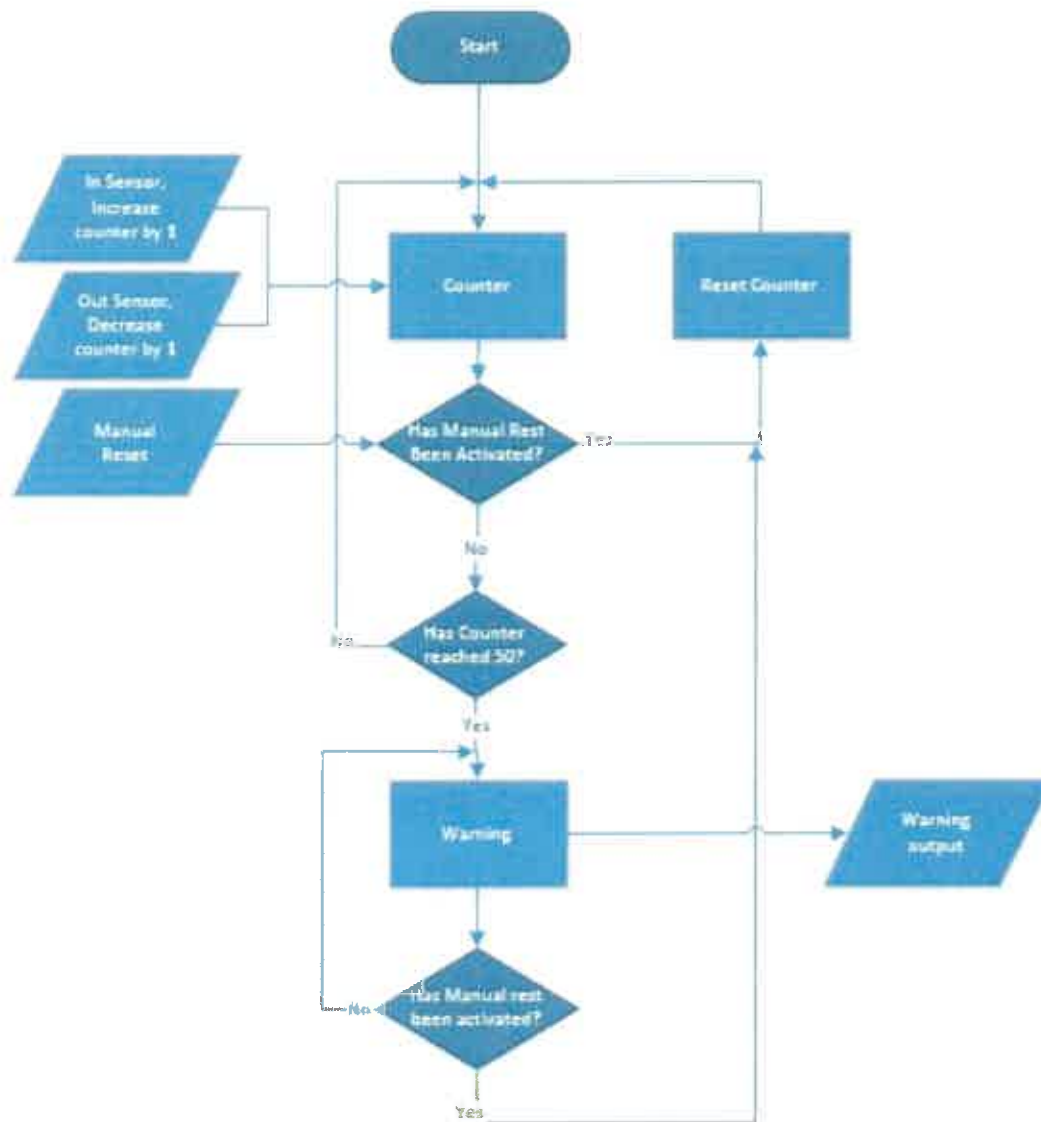


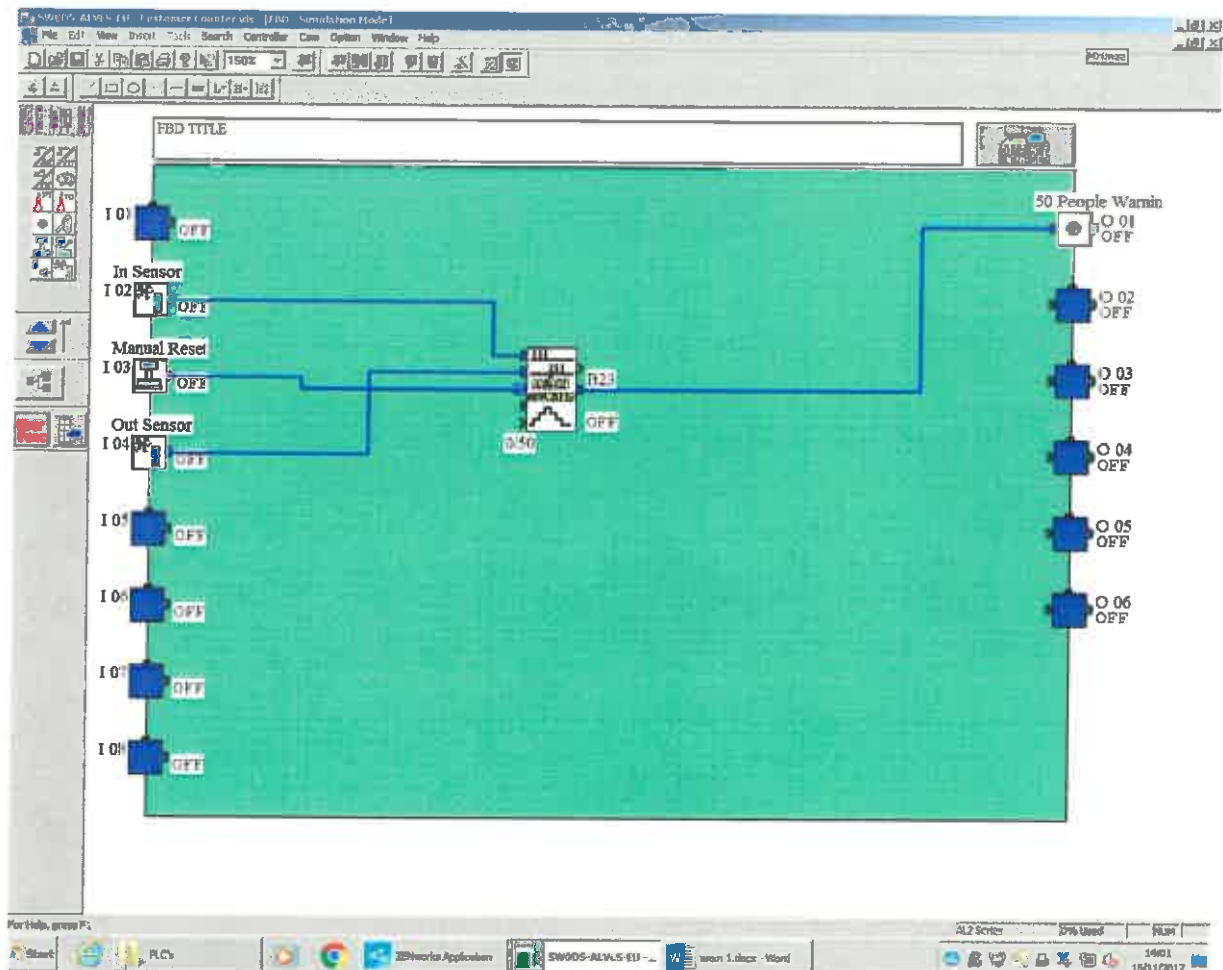
This program was to detect objects traveling down a conveyor, and once the system detects that 10 items had passed, it was to perform an action. The system was required to have a manual reset and an automatic reset once the system had performed its action, so it could continue counting.

The flow chart shows the light sensor input and the manual reset both attached to the counter, and the decision box connected to the output once the count has reached 10, the flowchart then loops around after the reset back to the counting system.

The Program has a light sensor input and a push button for the manual reset which are both connected to the UP- COUNTER, an ON-DELAY is connected to the output of the counter so that the system doesn't instantly reset and no output would be seen. A Output LED is also connected to the output of the COUNTER so that once the count has been reached, it acts as a visual interpretation of an action.

Task 4 Detection Counter





The task set was to design a PLC program to detect the amount of people entering and leaving a store, when 50 people entered the store, a warning was to be displayed to alert staff that the maximum had been reached.

The Flowchart shows the operation that the PLC program should follow and also shows the required inputs and outputs necessary.

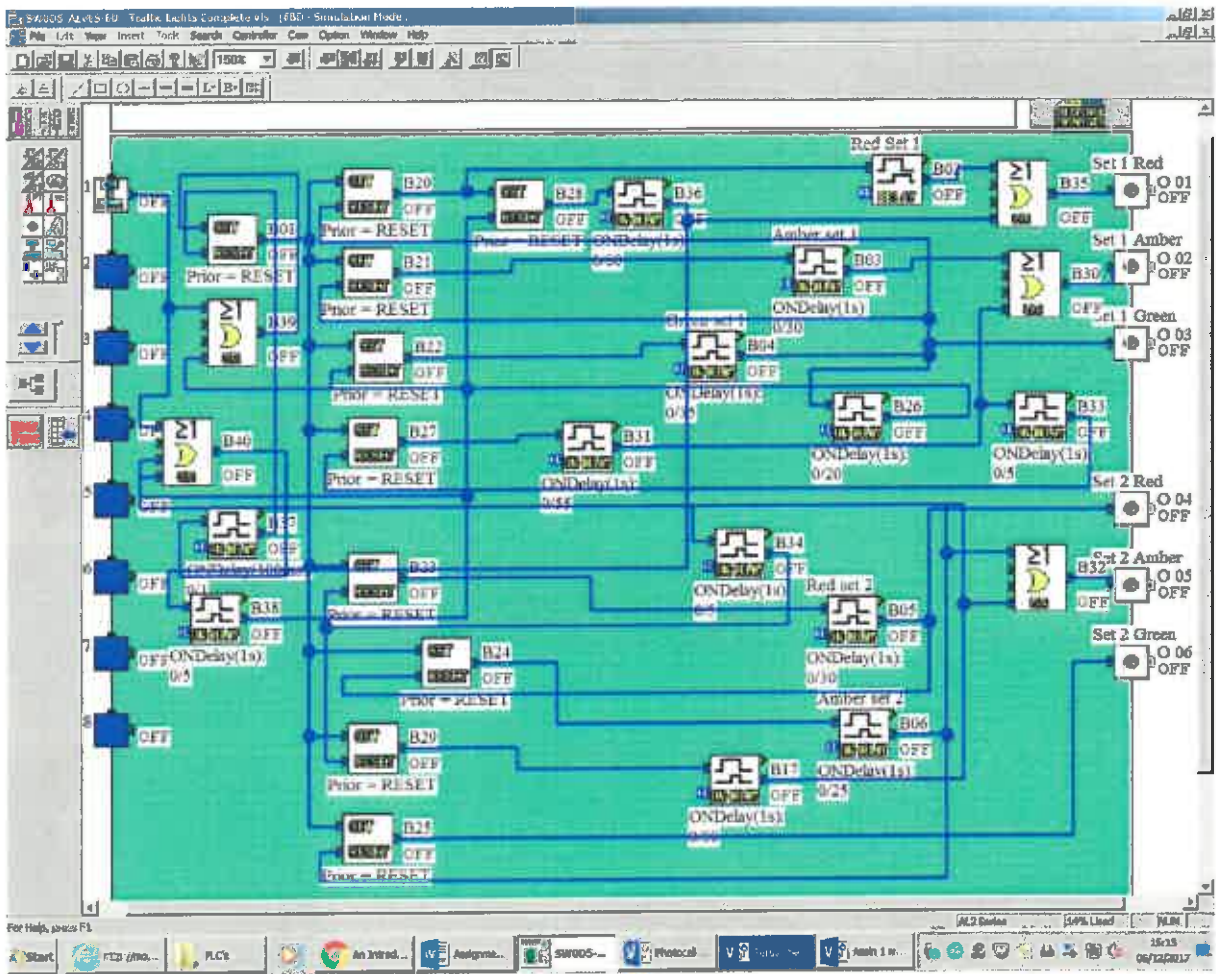
With the PLC system, A sensor to provide a high when someone enters the store is placed in the input side, a second sensor to provide a high when someone leaves the store is also placed on the input side, and a manual reset button that provides a high to the clear section of the counter is placed on the input side.

A UP/Down counter is used in the program with the IN sensor connected to the up count, and the OUT sensor is connected to the down count. The UP/Down counter is set to a limit of 50 counts and will provide a high output to the 50 People Warning LED once that limit has been met.

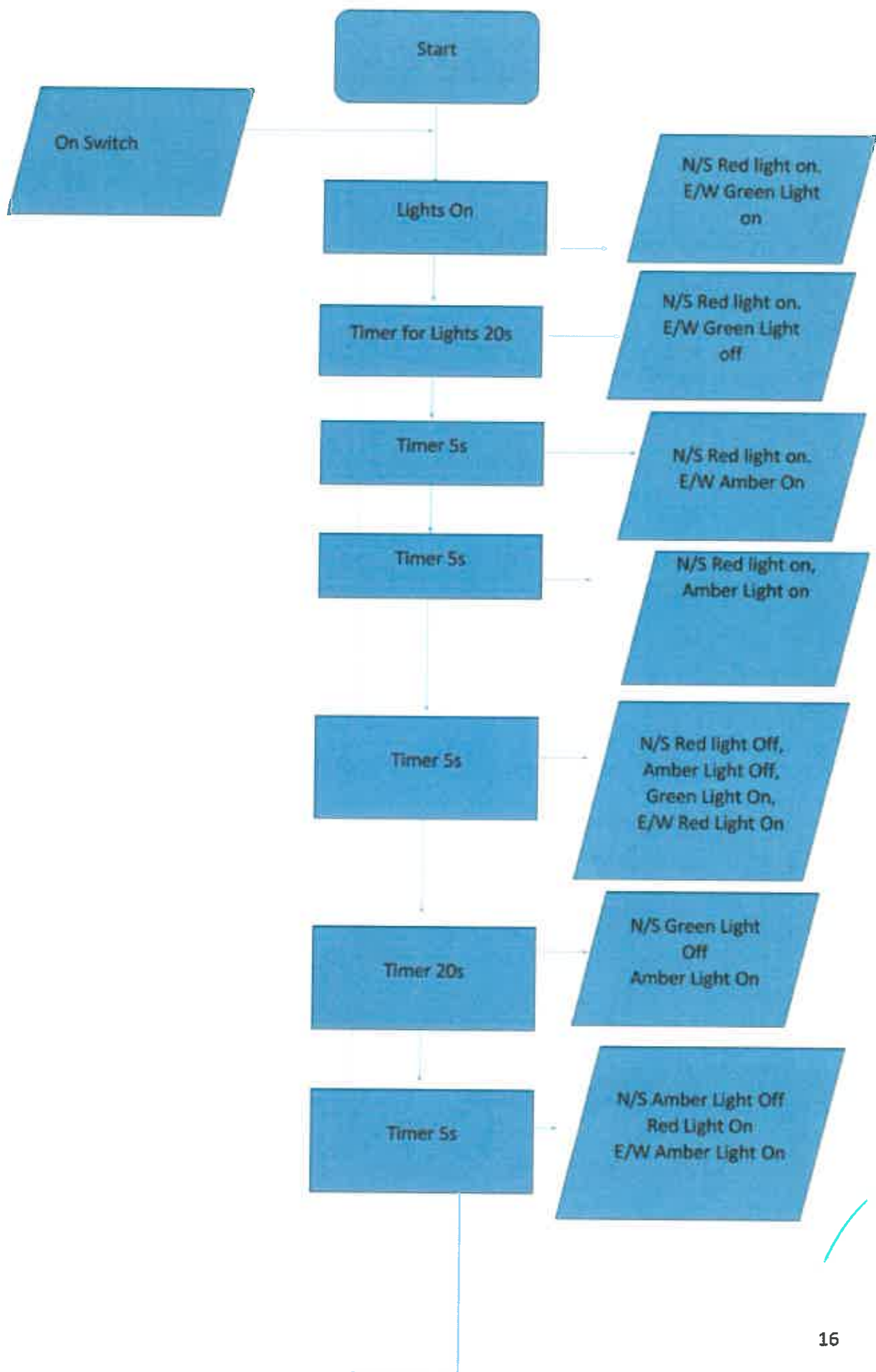
The manual reset button is connected to the clear section of the counter to reset the count back to zero.

SDP

Task 5: Traffic Light Programming Problem



	Timing (s)	5	10	15	20	25	30	35	40	45	50	55	60	
Set 1	North / South Traffic Light Sequence (N/S)													Return To Start
	Red													
	Amber													
	Green													
Set 2	East / West Traffic Light Sequence (E/W)													
	Red													
	Amber													
	Green													



This task was to create a PLC program of a 2-way traffic light system. Each set of traffic lights must run on certain timers and pose no danger to the drivers, e.g. green light in both directions. The system must follow the standard traffic light system, Green, Amber, Red. Red, Red-Amber, Green and loop continuously once started without delay, shortening of timings between light changes of multiple lights on simultaneously when not intended.

The flowchart shows the times between each light sequence, the outputs which should be on at each stage in the sequence and the loop back round to start the sequence over again, the timings are also verified with the timing diagram.

The PLC program consists of one input, a push button start, then 6 LED outputs appropriately named with the set of lights and the colours of each light within that set.

An initial SET/RESET which will loop the system after the initial push button start, with will then trigger numerous other SET/RESETS creating new sections. Each section then consists primarily of a number of delays. Most delays in this program are connected to an output and start counting initially and disable any 'earlier' outputs, by triggering the reset of the SET/RESET of the 'earlier' output once they are activated. This enables the program to follow the light sequence without having numerous lights on at once.

Once the final sequence has finished, it then will SET the initial SET/RESET, then after a delay of 100ms, RESET the initial SET/RESET, this ensures the SET/RESET does not interfere with the timings on the DELAYS.

This program was proven to work as intended while running on the software, Alpha Programming, but once connected to a PLC and corresponding circuit; there was a slight delay between the loops of the sequence. Attempts to rectify this issue resulted in either prolonging the delay, or disrupting the timings of the sequence and creating issues with the lighting order.

The issue was noted but the program left the same as it still functioned as required on the software version.

/SDP

References

<https://www.techwalla.com/articles/the-types-of-plcs>

W.Bolton (2006) Programmable Logic Controllers, 4th edition, Elsevier Newnes Publishing.