MAST Step Testing

Halma Water Management
June 2007

General

- Mobile Phones Please Turn Off !
- Special requirements for lunch.
- Smoking.
- Toilets.
- Coffee Breaks
- Fire procedures.
- Health and Safety while on site.

Agenda

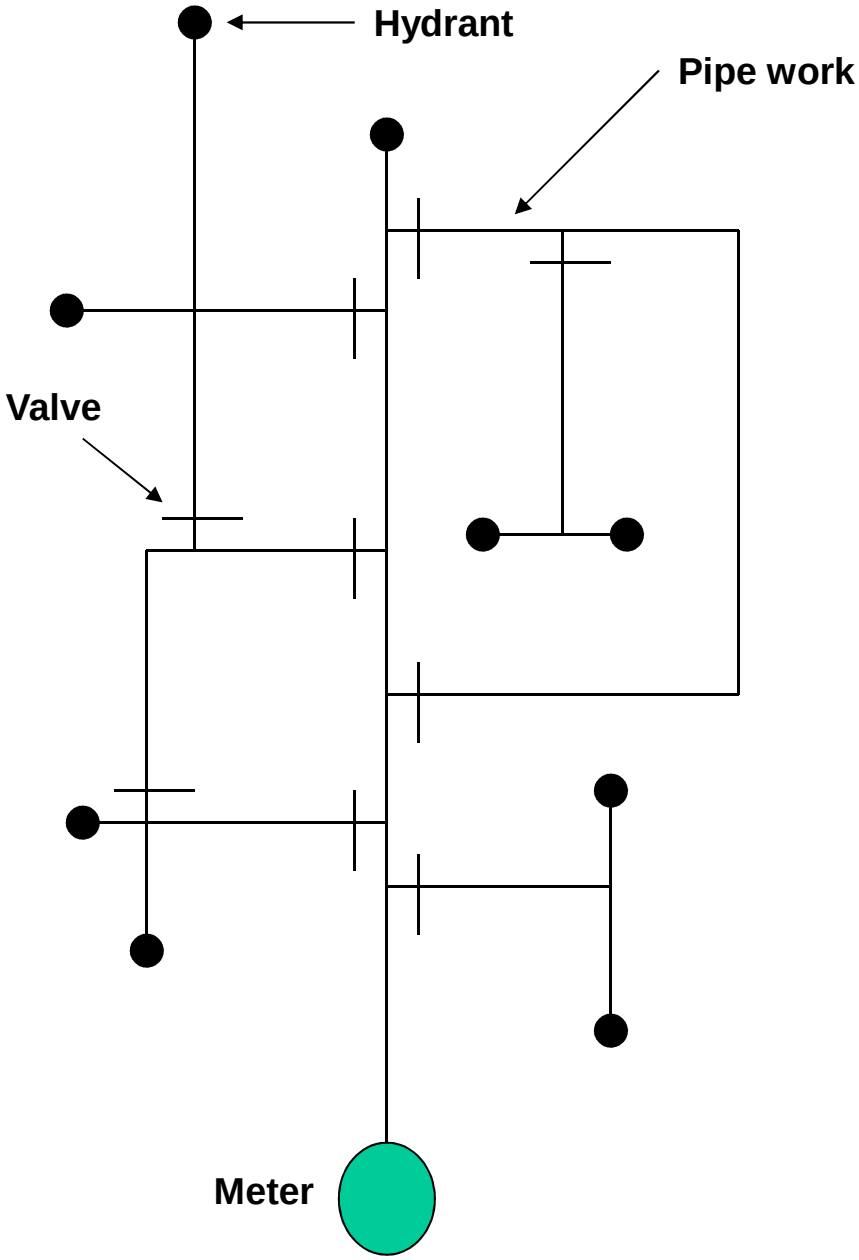
1. What Is Step Testing ?
2. Different Methods Of Step Testing
3. Network Problems To Avoid
4. Step Test Design
5. MAST Equipment Set-up
6. Recording Data
7. MAST Operation
8. Software
9. Interpreting Results
10. Avoiding Errors
11. Test Exercise

What Is Step Testing ?

What Is Step Testing ?

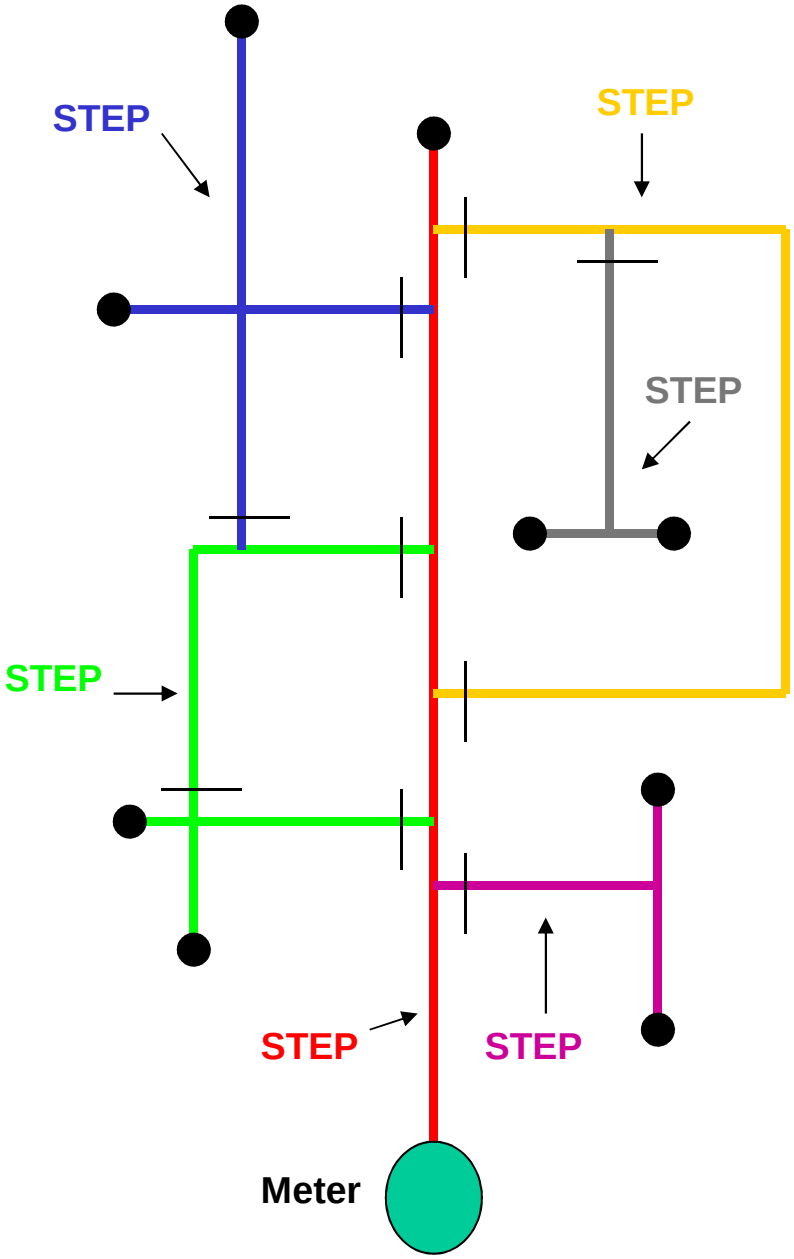
“Step Testing” is the process of localising leakage or usage into a particular section of the distribution system for subsequent pinpointing and repair.

It gives the follow up team a known area of investigation instead of blanket sounding.



The word “Step Testing” derives from the way a test is carried out.

The flow is recorded into the known area.



The network or DMA is split down into small sections.

Each small section is shut off in turn, these are called “STEPS”.

A new flow is recorded and the difference between the flows is your “STEP” value.

Hence why we call it **“Step Testing”**

Different Methods Of Step Testing

Different Methods Of Step Testing

1. Data Logger (without display)
   - No “real time” visual data.
   - Don’t see problems that can occur.
   - Manual time recordings needed for each step.
   - Need to wait for logger to record.
   - Can create water quality problems.

2. Data Logger (with display)
   - Requires extra person at meter point to radio / phone results through to valve operator.
   - Manual time recordings needed for each step.
   - Need to wait for logger to record.
   - Can create water quality problems.

3. Non Loggable Meters
   - All recordings are manual and prone to error.
   - Requires extra person at meter point.
   - Usually have to wait 15mins between steps.
   - Can create water quality problems.

Different Methods Of Step Testing

4. MAST or Telelink Step Tester

Records and displays real time data.

No manual recordings necessary.

No extra person required at meter.

Problems arising seen instantly on tester.

Step calculations undertaken automatically.

Minimal turn off time, lower risk of water quality problems and complaints.

TeleLink Step Tester

Digital step tester

Increased range than MAST
(Phone coverage)

Built in facility to deduct allowances

Smaller meter aerial, but larger
transmitter and receiver boxes

Displays flow every pulse

Line rental & call charges
(small cost)

Has pressure option

MAST Step Tester

Radio step tester

Best for use where “Phone Black Spots”

Range 10miles

Larger meter aerial, but smaller transmitter and receiver boxes

Displays flow on user setting

Has a pressure option

Network Problems To Avoid

Problems

1) Water Quality (dirty water) - Risk Assessment ?

2) Large Industrial Users - Inform of disruption, use alternative supply

3) Domestic Users (ie essential users, dialysis etc) - Inform of disruption

4) Valve Checking prior to test - Saves time and mistakes

5) Communication - Make your people aware

Charging The Network

“A step test is not a race”

Charge slowly and properly

Flush if / where necessary

Step Test Design

Valve Types

When planning a step test 3 kinds of valve descriptions are used to mark a plan :-

Boundary (Zone) Valves

These are the valves are permanently shut to “lock-in” and make “tight” your DMA

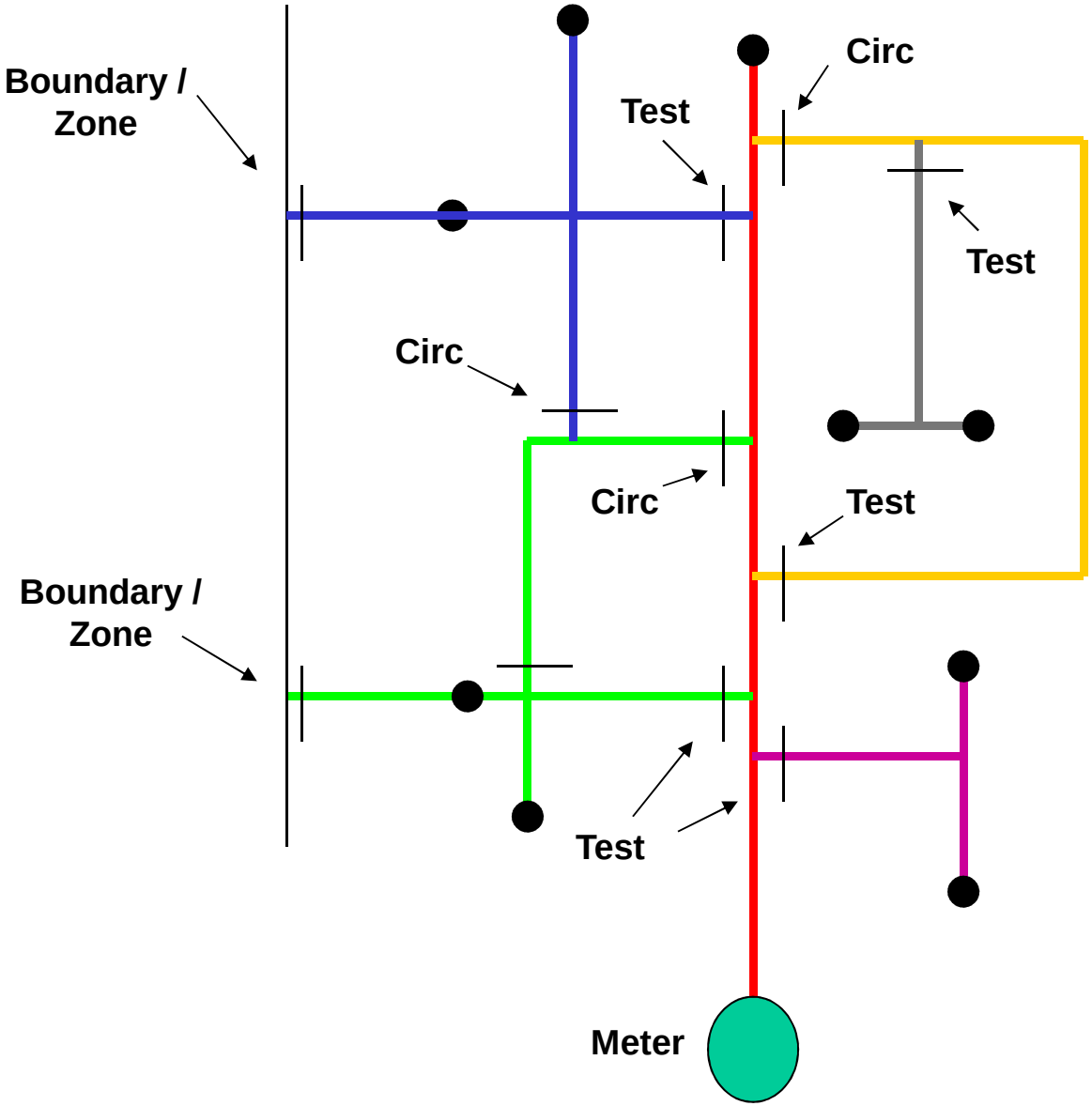
Circulation Valves

These valves are shut before a test commences, to divide up your DMA area into small sections with single feeds (where possible). These are only shut for the duration of the test and are re-opened after the test is complete.

Test Valves

These are valves which will be shut on the tests to isolate an actual step flow.

Valve Types


Boundary / Zone
Test
Circ
Test
Circ
Circ
Test
Boundary / Zone
Test
Meter

Different Styles Of Step Testing

There are 3 styles of step testing, before planning you must decide which one to use :-

1) Back Feed Method - The step areas are shut off but back feed from another DMA
   + Keeps step area's live at all times
   - Alters flow direction, can cause dirty water etc

2) Stay Shut Method - The step areas are shut off and left off
   + Easy way to determine step values
   - Step areas left off, possible long charging time, can cause dirty water

3) Close & Open Method - The step areas are shut off long enough to register and then opened
   + Less chance of causing dirty water
   - Need to do more calculations to determine step values

Popular

Planning

Try and design your test using the “tree” method.

Imagine your network is a tree, the main feeder main is the trunk and the branches that hang off the tree are the step areas.

Start with steps at the top of the tree that connect to the trunk, those which are furthest away from the meter and work back to the meter.

If possible plan your test so each step area will only be shut off once to avoid the minimum disruption to the network (This is not always possible)

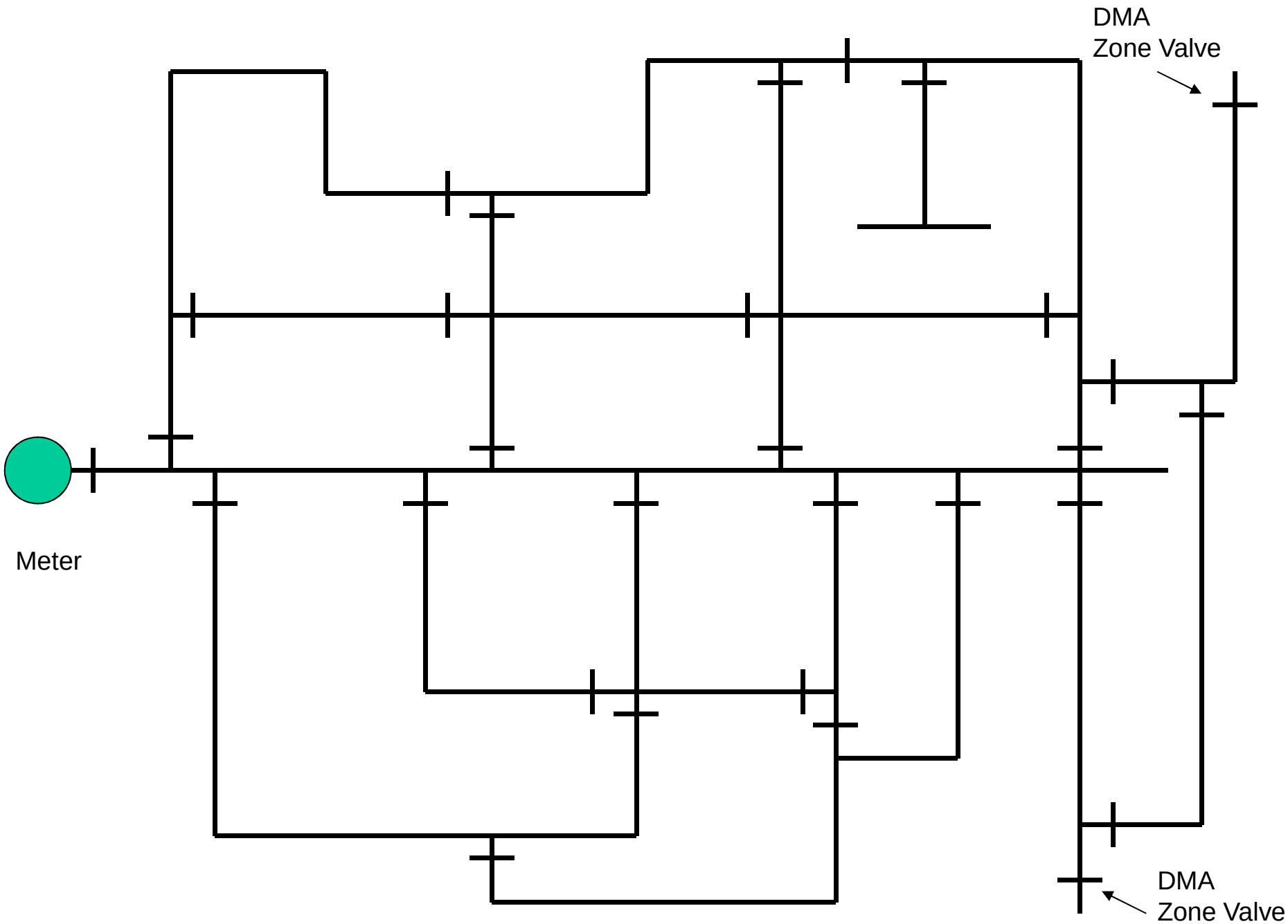
The last test is usually the main feeder main and this may not have to be turned off if all the other steps can be deducted from the flow to give you your remaining figure.

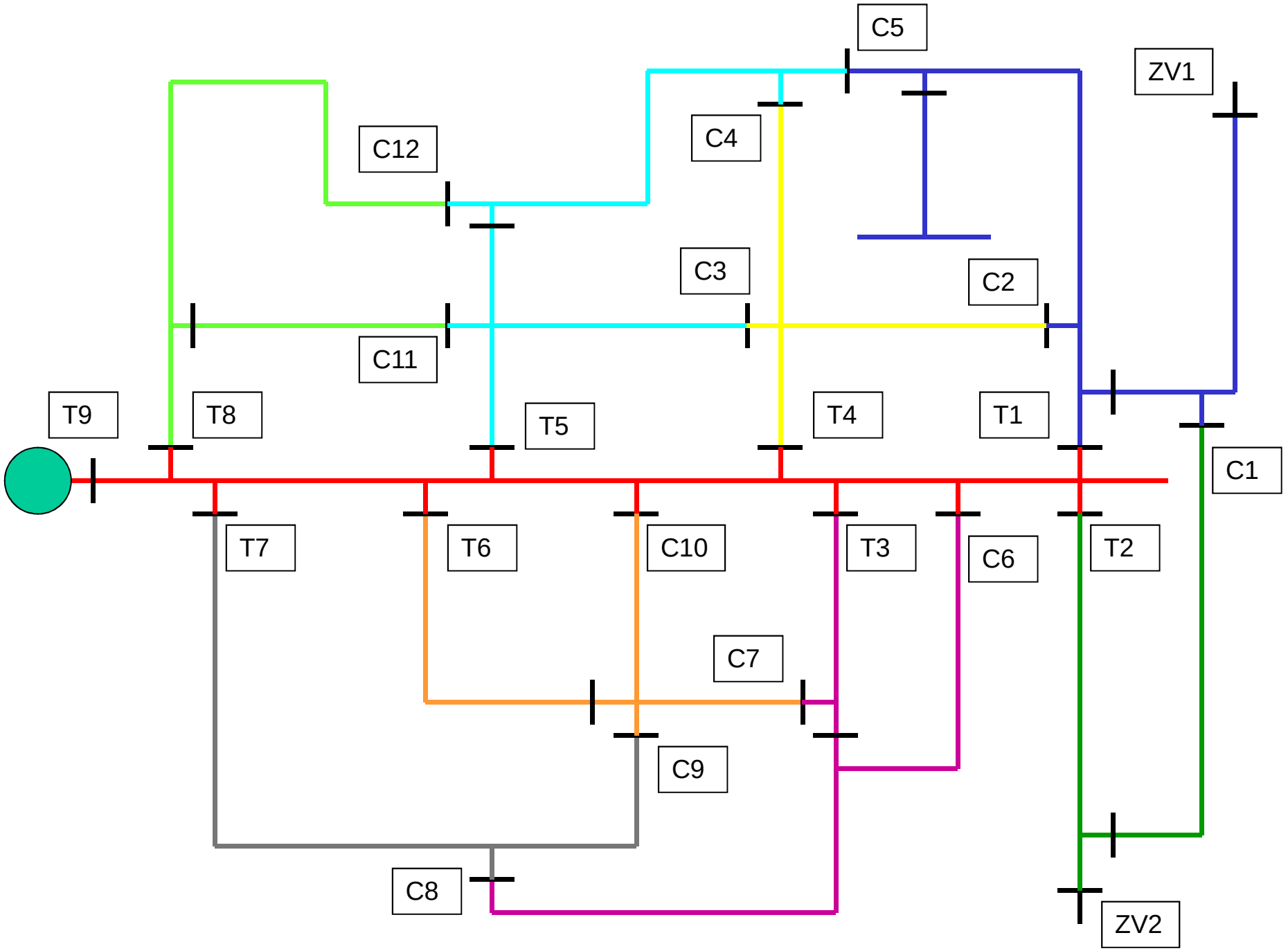
Step Area Size

The quantity of properties in each step area may depend on the following :-

Size of DMA
Leakage to account for
Difficulty due to network problems

As a general guide, 100 properties per step area


DMA
Zone Valve
Meter
DMA
Zone Valve


C5
ZV1
C12
C4
C3
C2
C11
T9
T8
T5
T4
T1
C1
T7
T6
C10
T3
C6
T2
C7
C9
C8
ZV2

Valve Schedule

Step Test Valving Schedule

DMA Name	Test Area	DMA Number	555

Test Details:

Valve Number	Operation	Time	Flow(l/s)	Comments
Circ 1	Shut	02:00	10	
Circ 2	Shut	02:15	10	
Test 1	Shut	02:20	8	
Test 1	Open	02:25	10	
Test 2	Shut	02:37	9	
Test 3	Shut	02:51	5	

This should include any DMA Zone Valve checks

Practical

For the step test plan (2 slides earlier) write down the valving schedule order for :-

1) Stay Closed Method

2) Close & Open Method

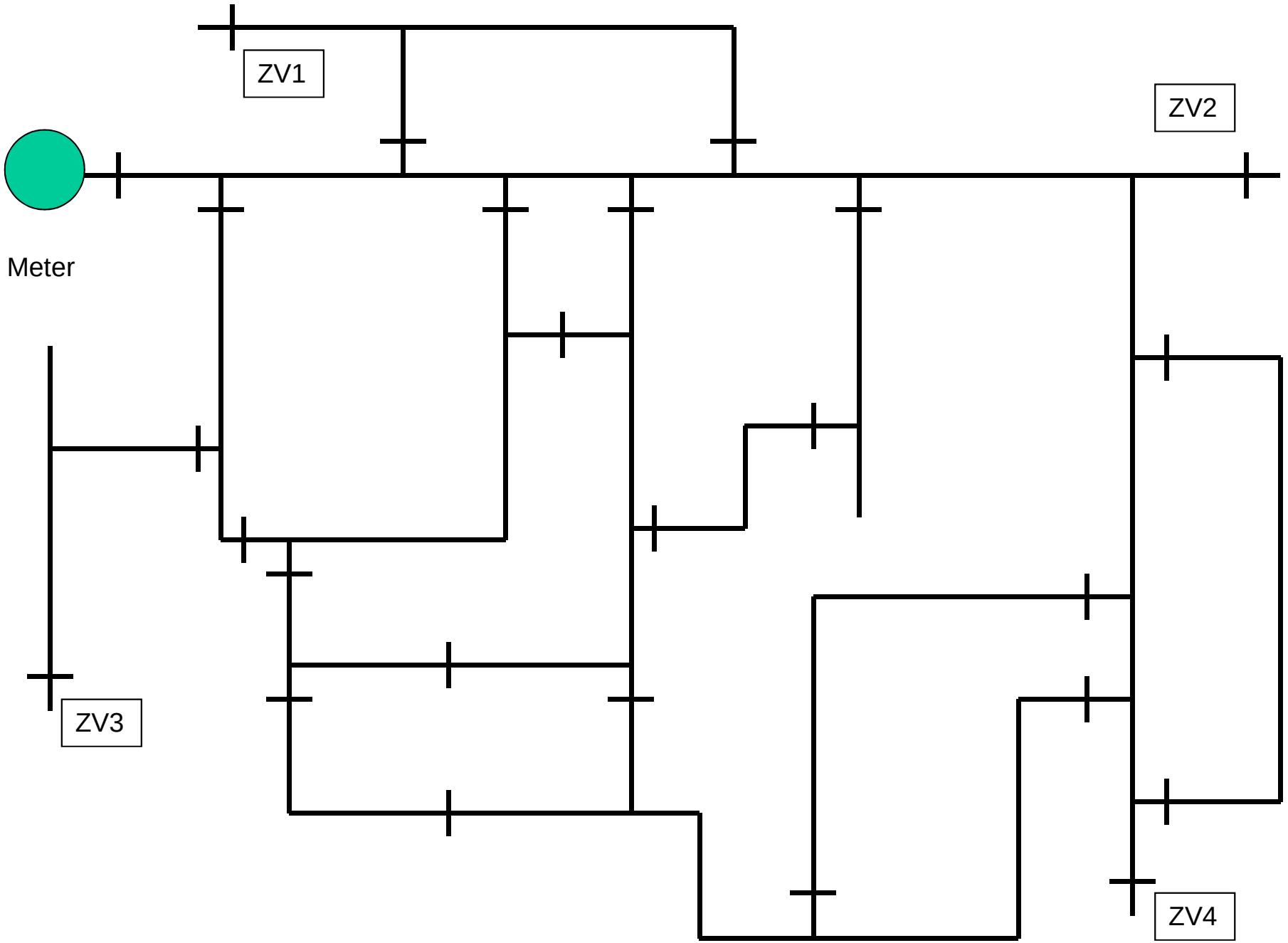
Practical

1) Using the following slide, design a step test with at least 9 steps.

The test must be designed so that each test is only turned off once (with the exception of the last test from the meter)

2) Make out a Stay Closed Method Valve schedule

3) Make out a Close & Open Method valve schedule


ZV1
ZV2
Meter
ZV3
ZV4

MAST Equipment Set-up

M obile

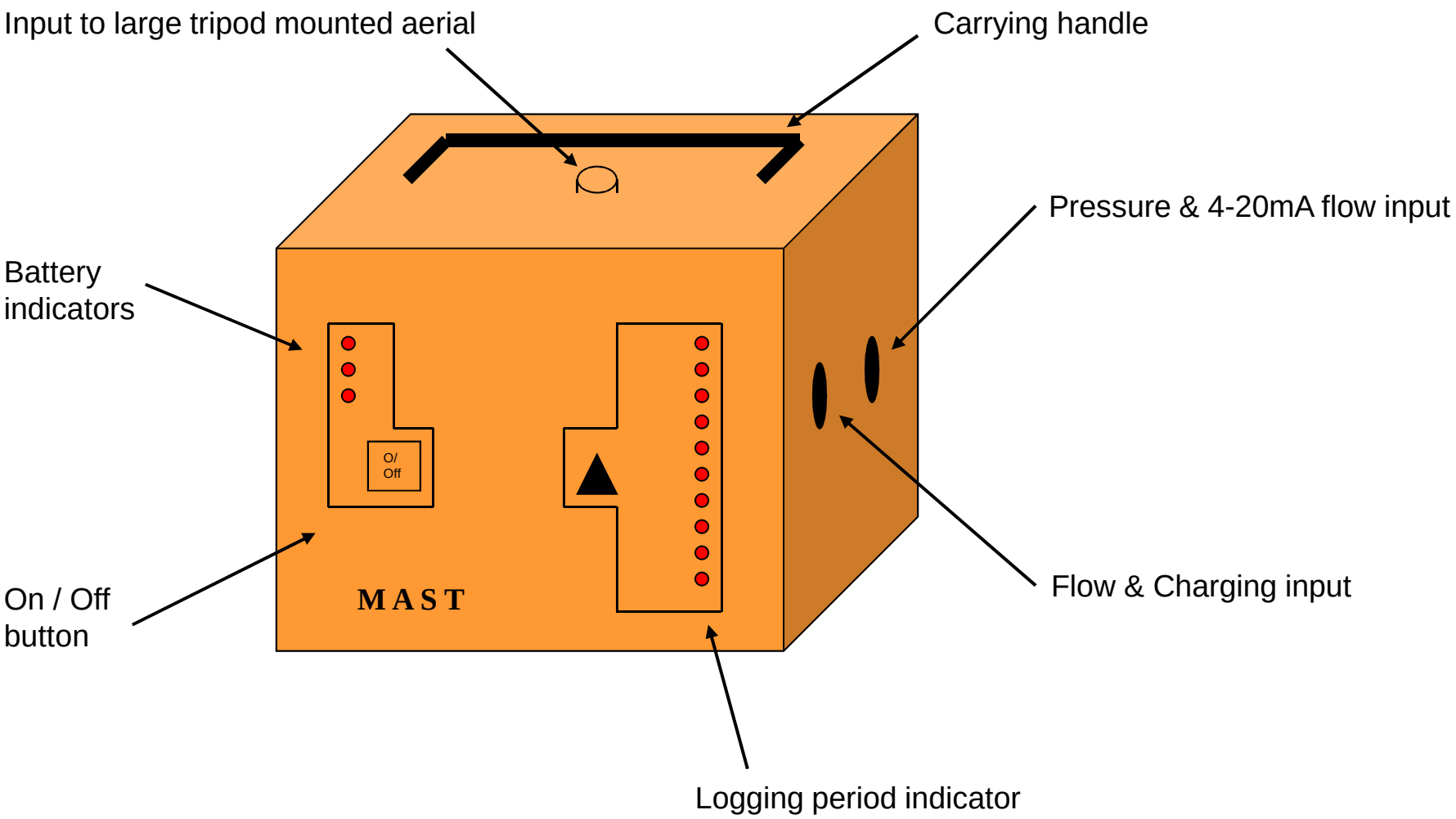
A dvanced

S tep

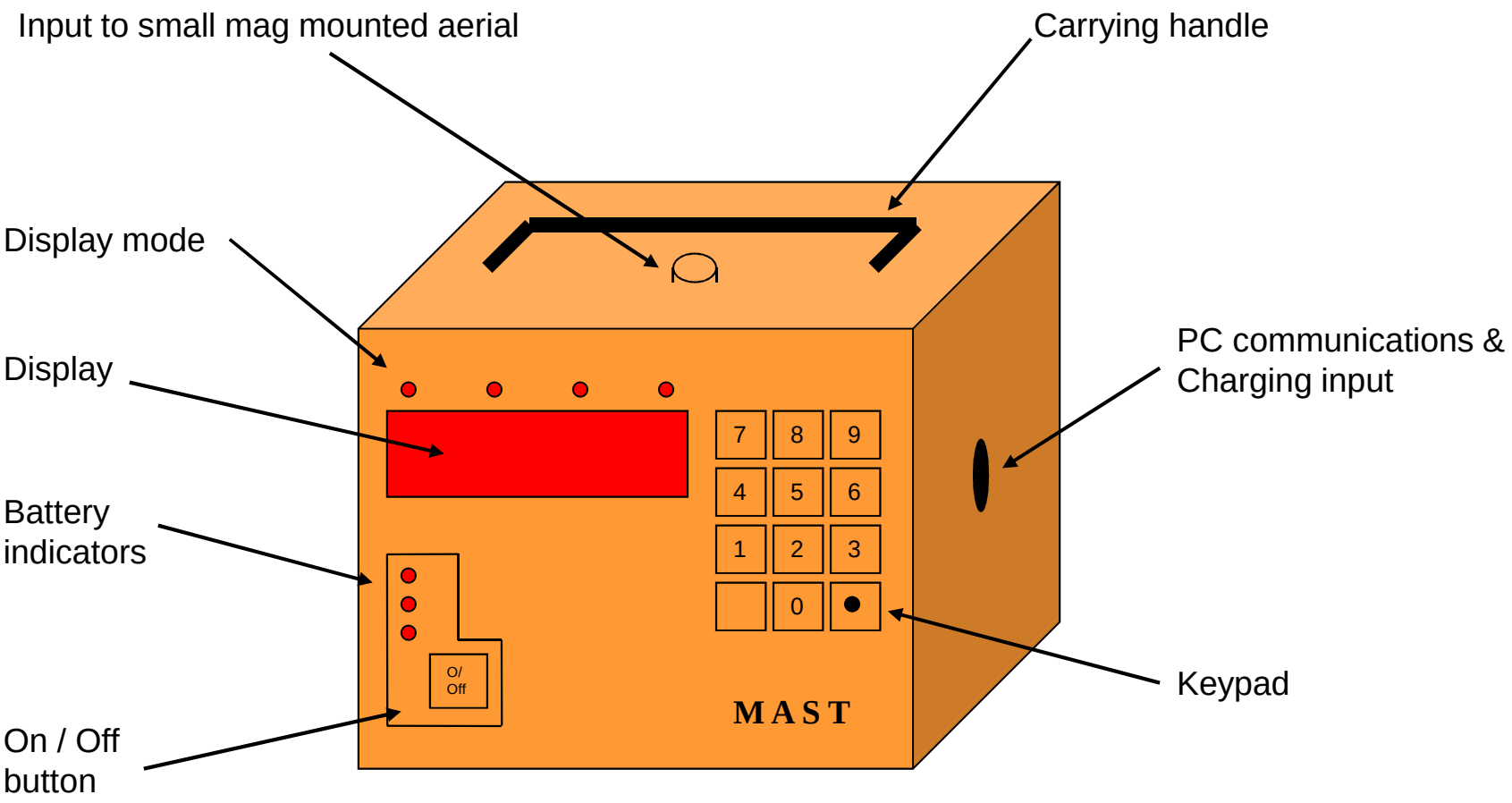
T ester

Flow data is transferred via a radio telemetry link to achieve real time step testing, with results displayed to the user as each valve is operated.

Transmitter Unit



Receiver Unit



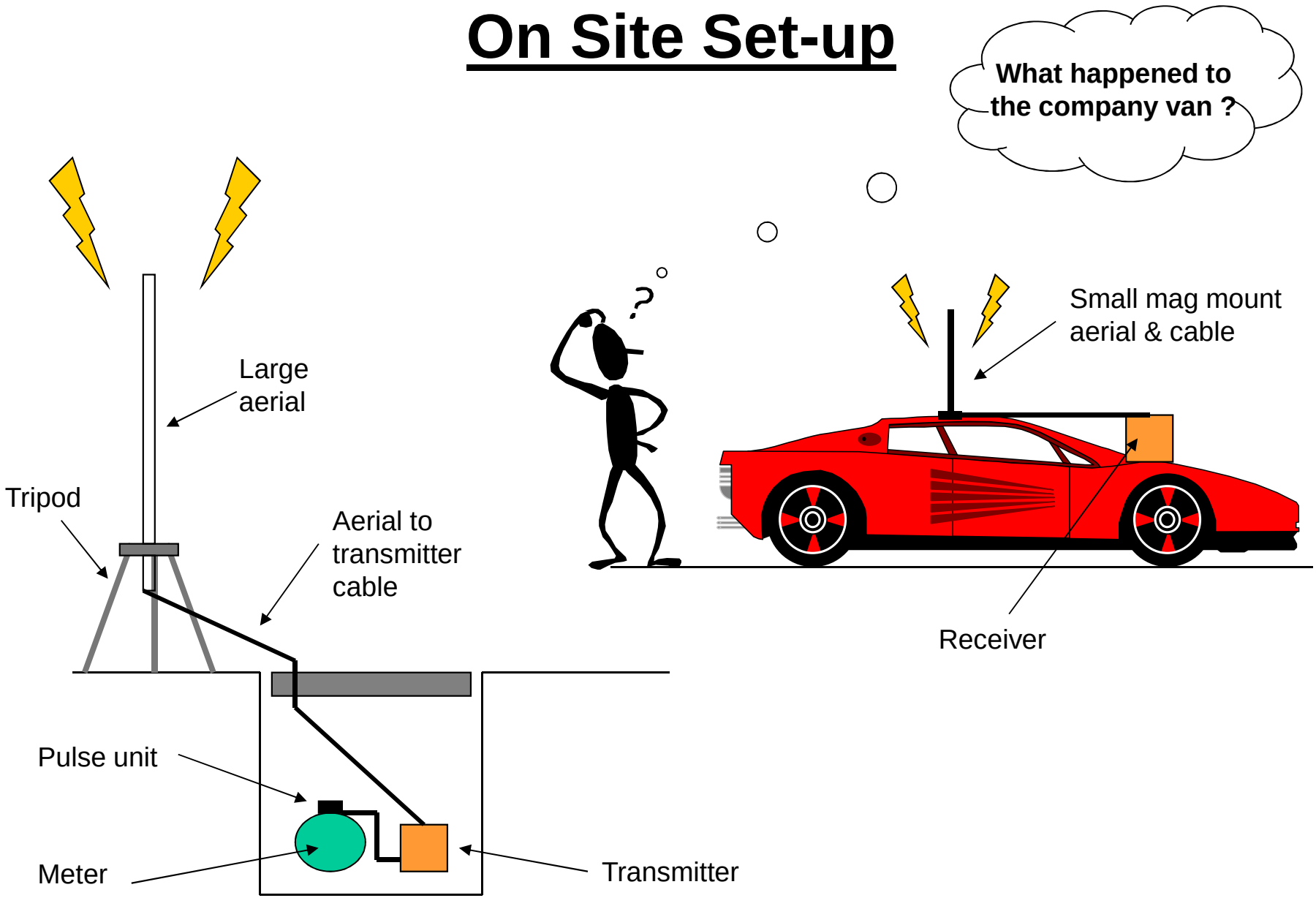
Charging

To charge the MAST :-

1) Plug in the 6 pin charging cables into the transmitter and receiver
2) Turn “Off” the charger
3) Connect the RED plug from one cable to the RED socket on the charger
4) Connect the **BLACK** plug from the same cable to the **BLACK** socket on the charger
5) Connect up the remaining cable the same way
6) Turn charger “On”

Typically fully discharged batteries require approximately 5 hours to become fully charged

On Site Set-up



Recording Data

What suits you best ?

We recommend you always make out a valving schedule plan.

Valves can be forgot when you get tired !

Recording methods :-

1) Software

2) Step Test Report

Valving Schedule Plan

Step Test Valving Schedule

DMA Name		DMA Number	

Test Details:

Valve Number	Operation	Time	Flow(l/s)	Comments

Step Test Report

Step Test Report

DMA Name		DMA Number	
Date		Number of Tests	
Initial Flow (l/s)		Finish Flow (l/s)	
Start Time		Finish Time	

Test Details:

Test Number	Time	Initial (l/s)	Reduced (l/s)	Step (l/s)	Comments
1					
2					
3					
4					
5					
6					
7					

MAST Operation

Checking Version No.

Finding out MAST version number :-

1) Switch receiver unit “Off”
2) Hold key “6(Test)” down and turn receiver “On”
3) The version number will flash up

Version 1 - Standard flow only, but will not display the version number
Version 2 - Standard flow only
Version 3 - Pressure upgrade
Version 4 - Pressure & Flow transducer (with 4-20mA output signal)

When reading the version number >2 but <3 means Version 2
When reading the version number >3 but <4 means Version 3
and so on …...

Checking Memory

To check memory availability for storing data :-

1) Turn “On” receiver
2) Press “6 (Test)”
3) The receiver will display the following :-
    MAST ID No.
    No. of memory stores available
    Memory check (carried out by the unit which should say “Pass”)

If the memory availability says “0” then the memory must be cleared before use.

This can only be done via the MAST software.

Maximum memory availability on version 1 is 3358 and on all other versions is 3200.

Setting Up The Receiver

To check the time

1) Press “3 (Time)”
2) Enter new time (24 hour clock) using keypad numbers
3) Press “Enter”

This can also be synchronised via the MAST software

The date can only be checked and set via the MAST software

Setting Up The Receiver

Connect small magmout aerial

Setting the flow units

**This can be in either Litres / Second (l/s), Cubic Meters / Hour (m3/h)
or Cubic Gallons / Hour (g3/h)**

1) Press "Enter"
2) Press "1 (Head)" for l/s, Press "2 (Set Ref)" or m3/h or Press "3 (time)" for g3/h
3) Press "Enter"

Setting meter type

This is the meter scale factor in Litre per revolution (ie either 10,100 etc)

1) Press "0 (Meter)"
2) The display flashes "l-r" prompting the scale factor input
3) Enter the correct factor using the keypad numbers
4) Press "Enter"

Setting Up The Receiver

Setting the head type

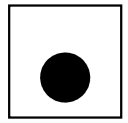
This is determined by the type of pulse unit being used.
The MAST is usually supplied with a HRP.

Type	Pulses
PU10	10
LRP	10
PU100	100
HRP	100

1) Press “1 (Head)”
2) The display should flash “Head”
3) Enter the correct pulse value using the keypad numbers
4) Press “Enter”

The receiver is now set ready for operation, now the transmitter can be turned on and set up.

Checking Set Up Of The Receiver

You can check the set up of the receiver by pressing  **(the decimal point button)**

This scrolls through your flow units, meter and head values.

Setting Up The Transmitter

Connect pulse unit to meter and connect to side of transmitter

Assemble large mast aerial and connect to top of transmitter

Turn “On” transmitter

Select logging interval by pressing 
(Suggest 15 secs for a standard test)

Check the correct flow appears on receiver, the “Data” LED will light on the receiver and bleep if data is accepted ok.

Place transmitter in meter chamber and commence test

Storing Information During Test (Using Software)

Setting the DMA reference number is used when downloading data, but also sets a flow value static to give you a constant starting base level for reference

1) Press “2 (Set Ref)”
2) Display flashes “dist”
3) Enter DMA number using the keypad numbers
4) Press “Enter”
5) The “Ref” LED light comes on
6) Press “8 (Flow)” to revert back to flow updates

Note:- References can’t be set at “0000” or “9999”, these are reserved for printing routines

Once the DMA reference is set all transmitted data is now stored automatically.

Storing Information During Test

To store the individual steps :-

1) Shut off the step area
2) Wait for the flow to settle (at least 3 bleeps)
3) Press “4 (Store)”
4) The display will flash “F.rEF”
5) Enter step number using keypad numbers
6) Press “Enter”

Note:- This facility will only work if the DMA reference has been set previously

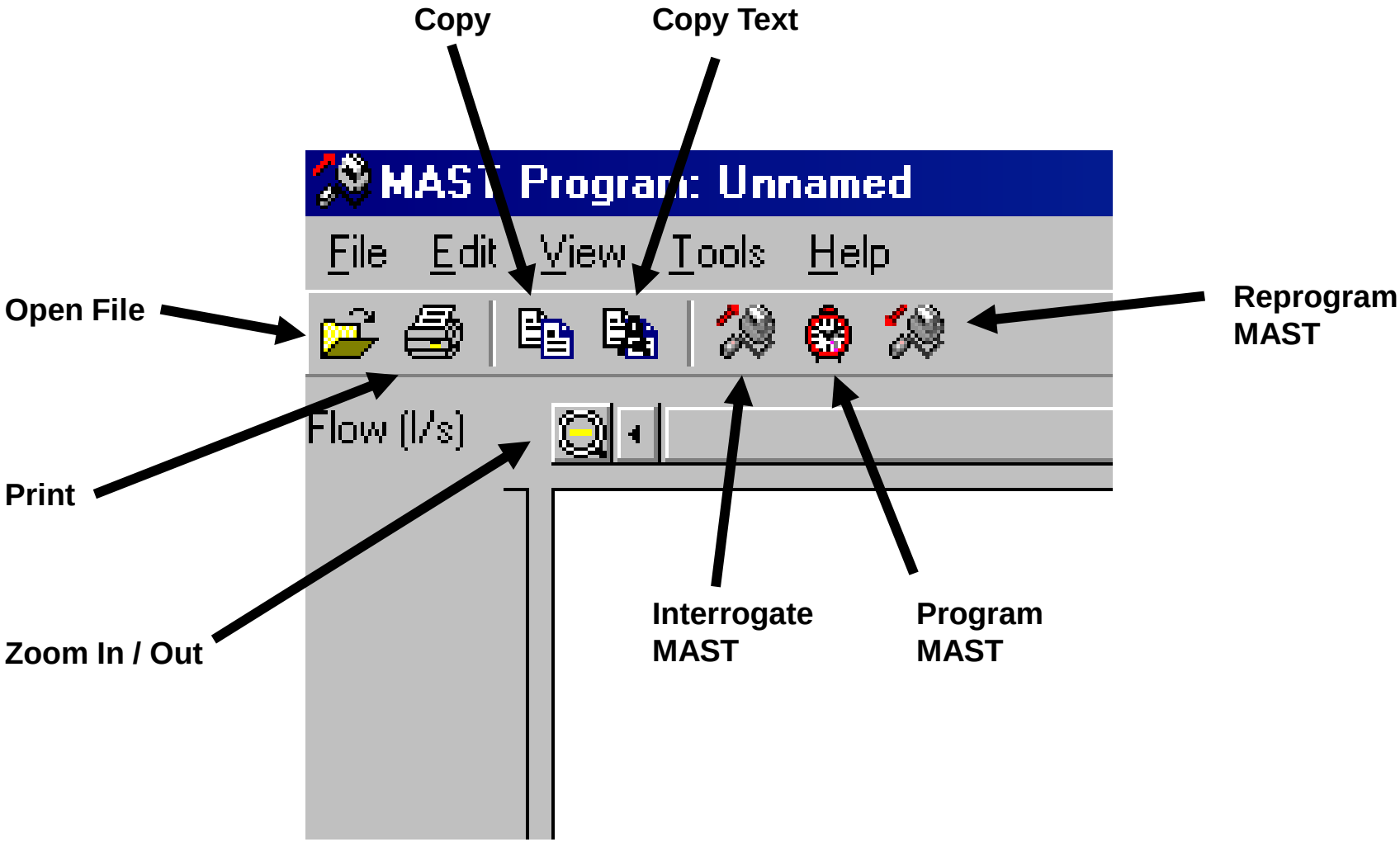
Step Value Display During Test

An on site “Step” value can be obtained from the MAST :-

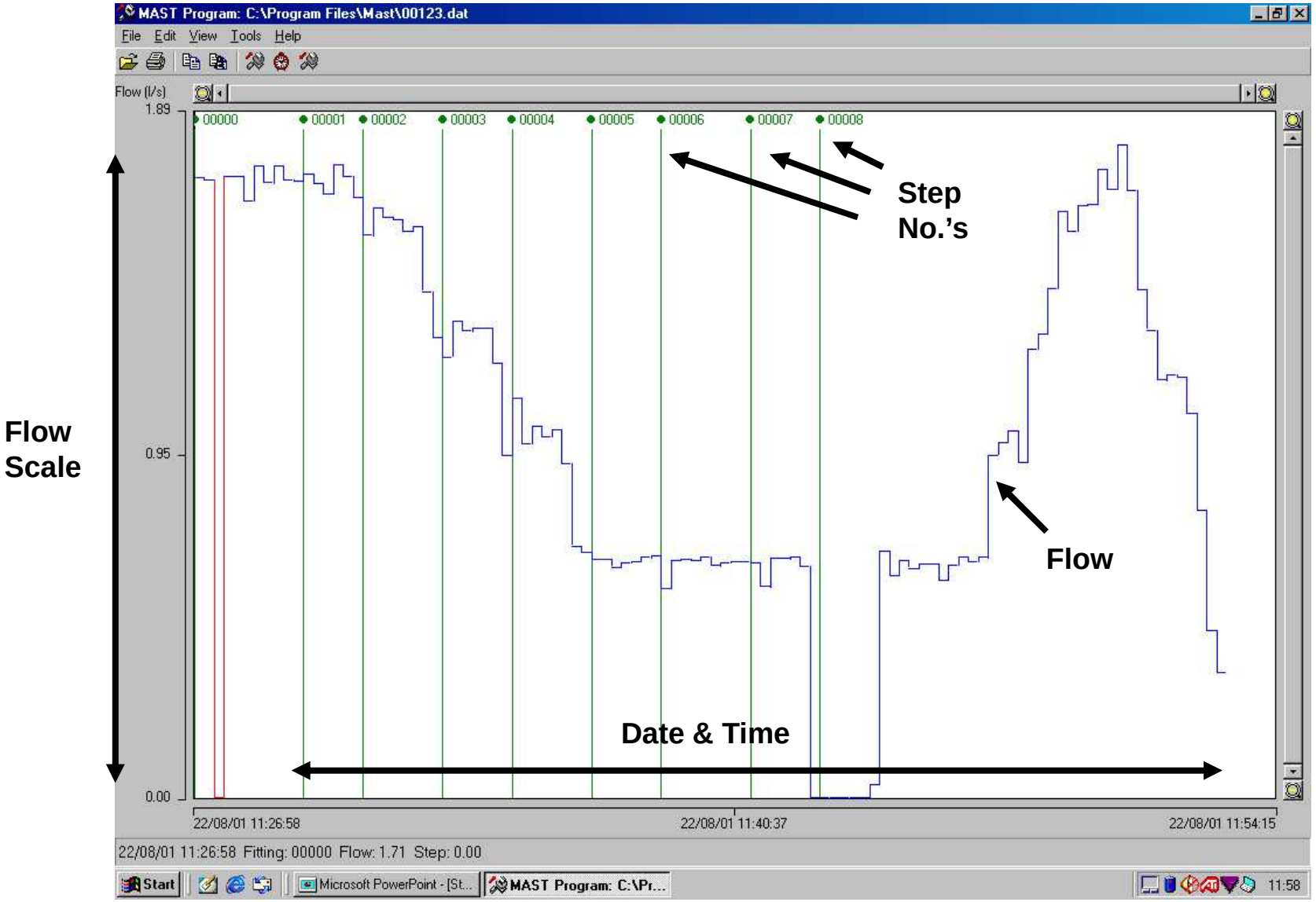
1) After turning off the step area
2) Let the flow settle
3) Press “9 (Step)”
4) Displayed is the difference between the reference flow and the new flow
5) Press “8 (Flow)” to return to current data

Software

Icons

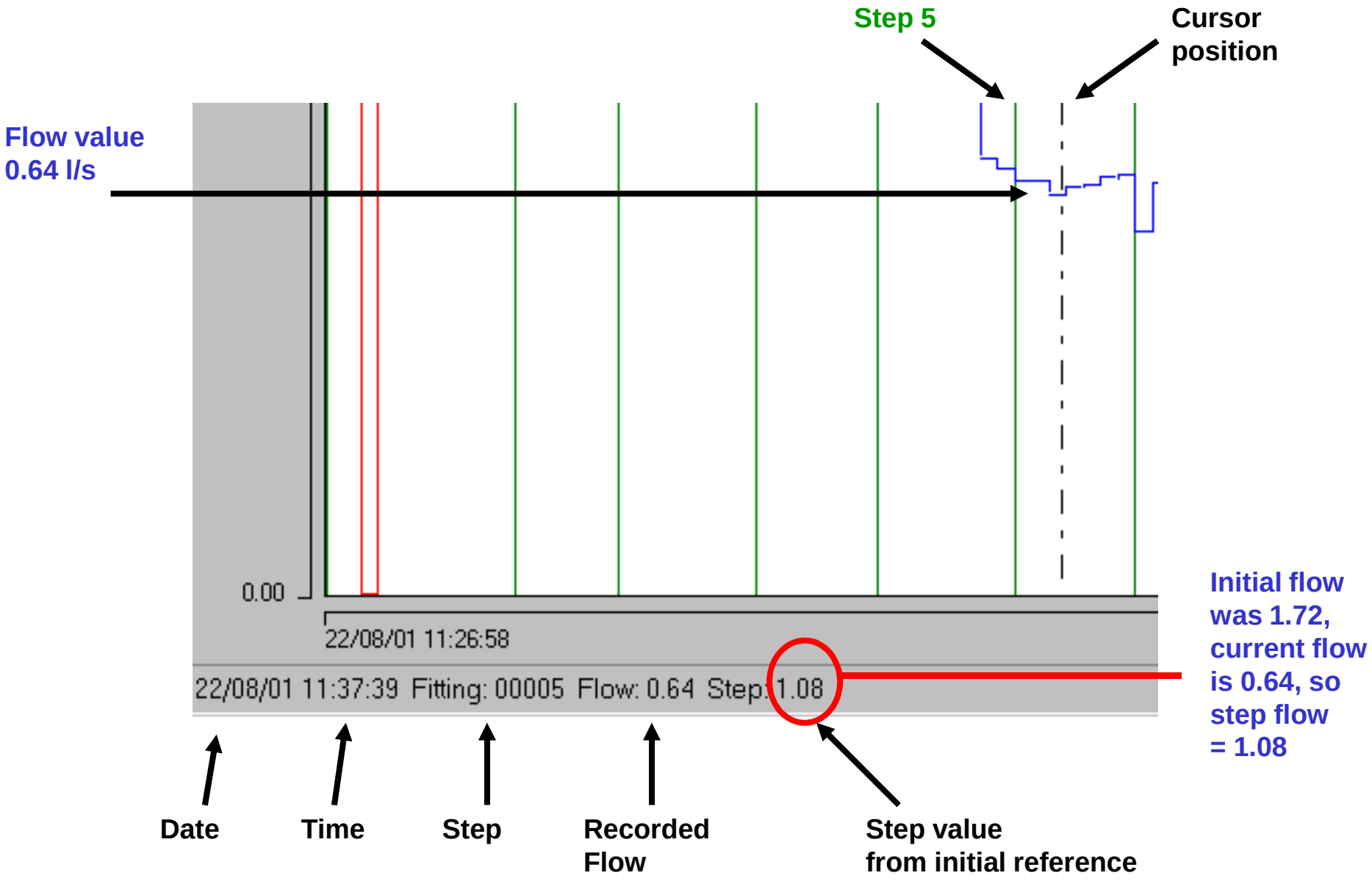

Copy
Copy Text
MAST Program: Unnamed
File Edit View Tools Help
Flow (l/s)
Open File
Print
Zoom In / Out
Interrogate MAST
Program MAST
Reprogram MAST

Screen Display

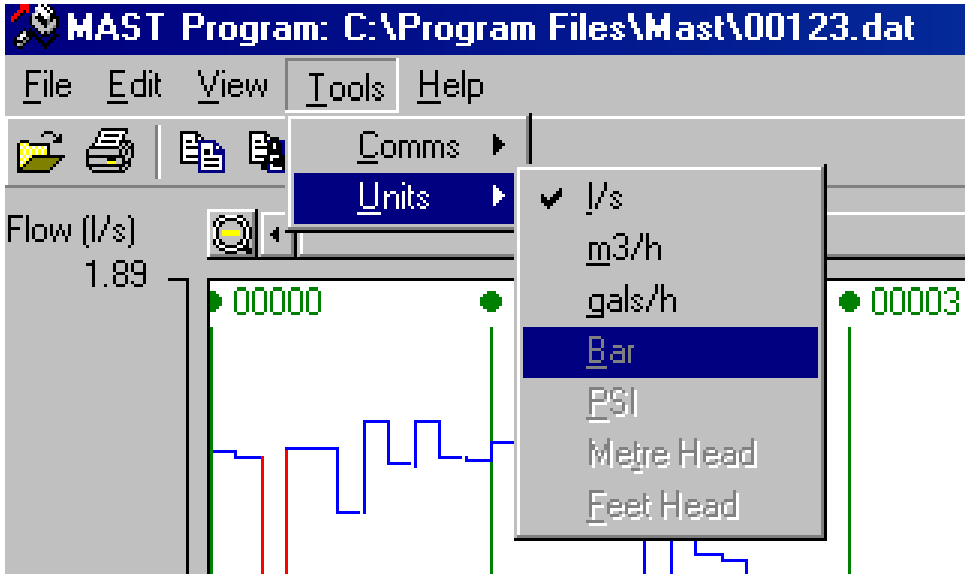


Flow Scale

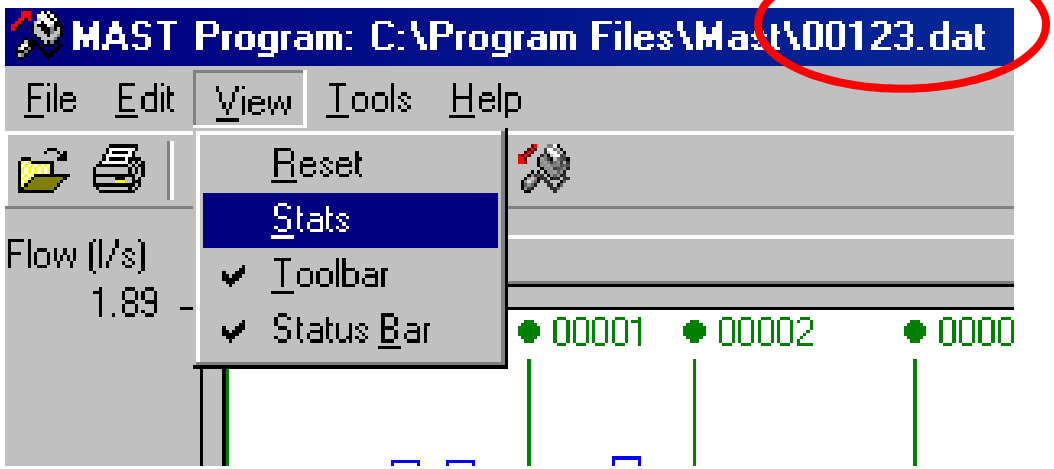
Cursor Position Information



Menu Options



To change units select
1) Tools
2) Units
3) l/s, m3/h or gals/h

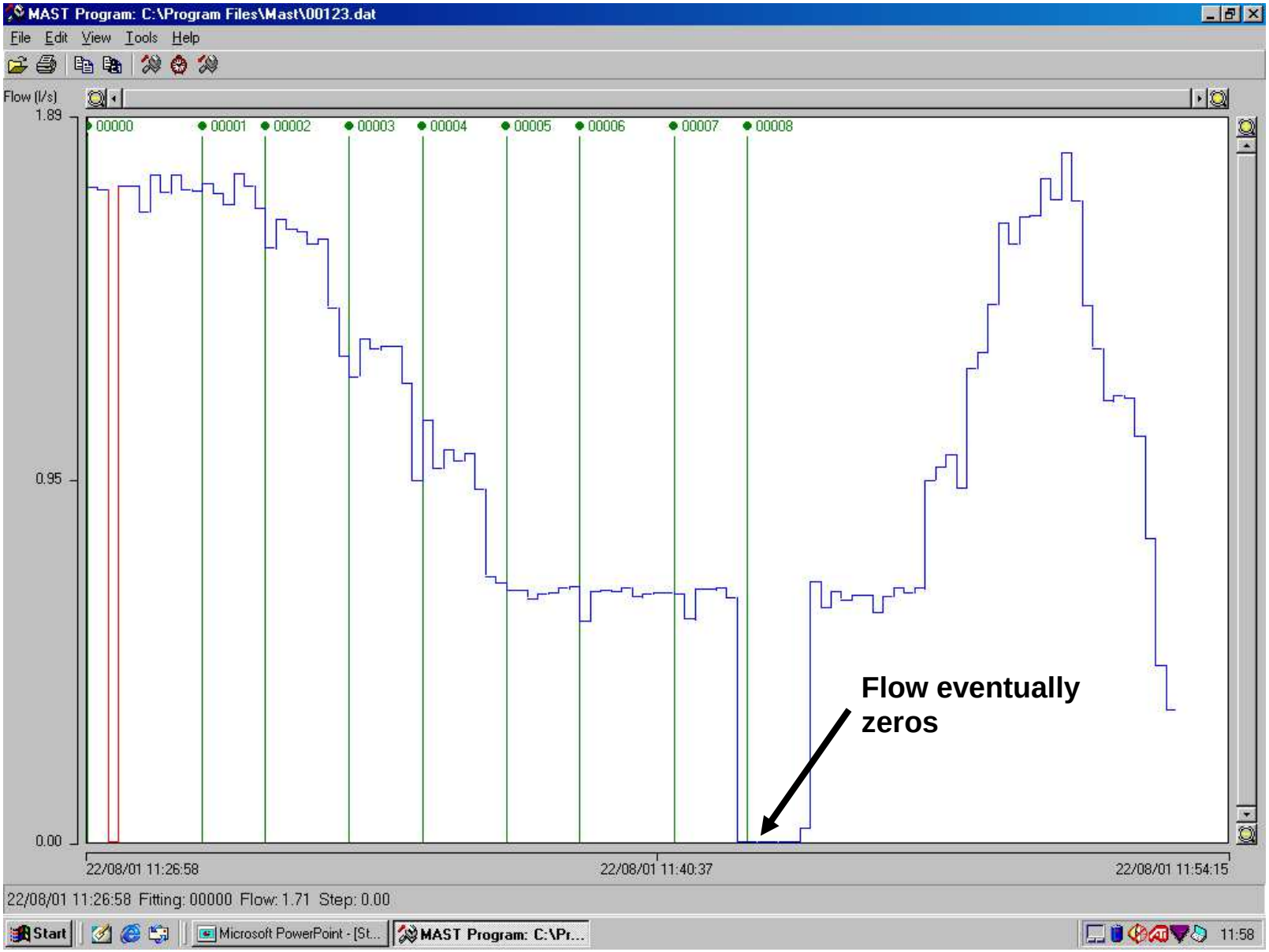


Note
The saved file name is the 5 figure district reference entered at start of test.

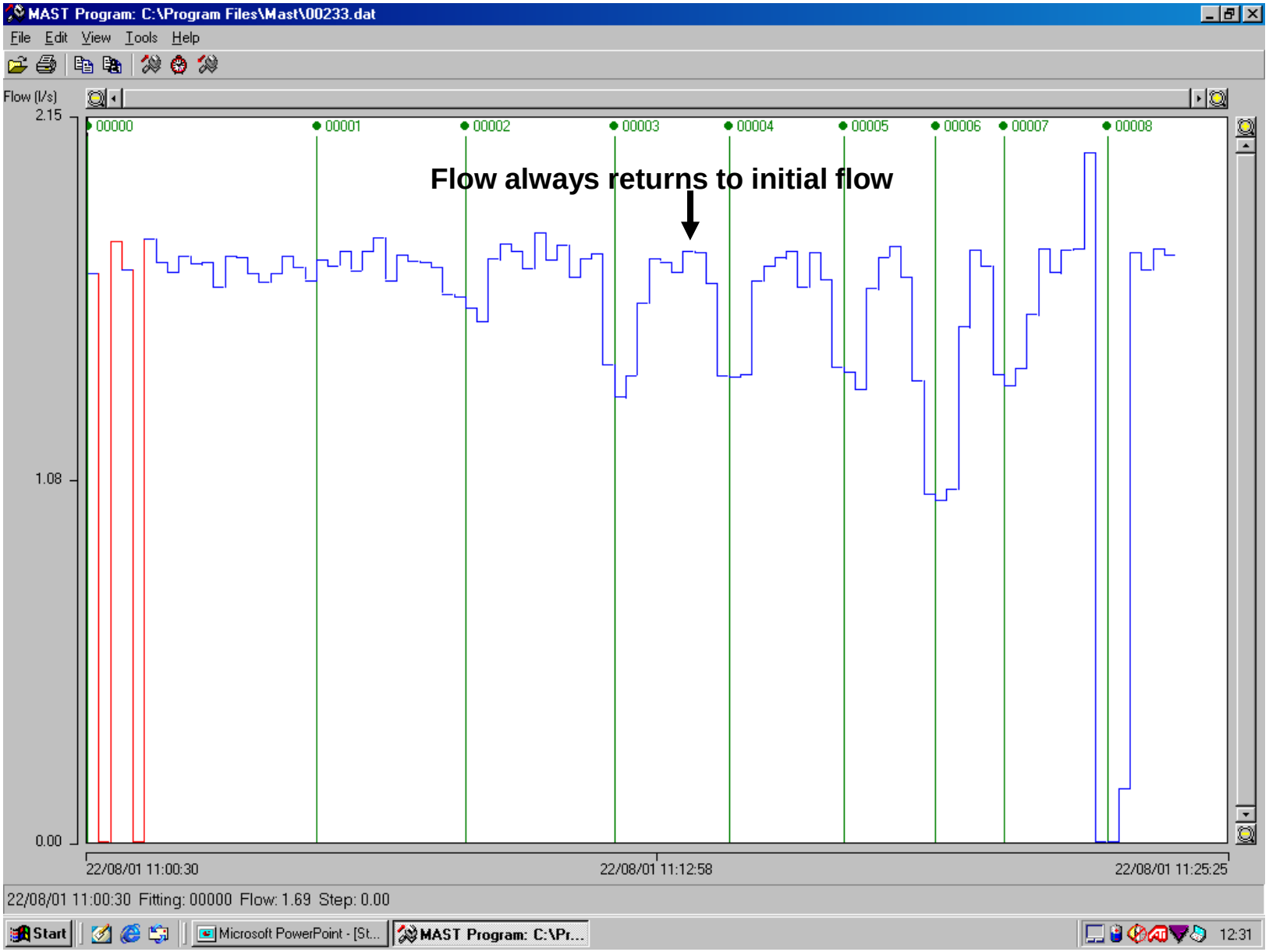
To view a table of results instead of graphically
1) View
2) Stats

Interpreting Results

Left Closed Test Results



Closed & Opened Test Results



Avoiding Errors

Avoiding Errors

Always set up the receiver unit before turning on the transmitter unit

Check date and time are correct (mainly when using software)

Don’t change date and time when carrying out a test

Don’t use district reference 0000 or 9999, these are used by the MAST already

Best reception when the receiver is stationary

Data corruption can occur if a MAST with the same ID No. is being used in the same vicinity at the same time

Don’t turn off PC while MAST is connected via interrogation cable

Check battery level is good before commencing test

Check enough memory bytes are available before carrying out test (if storing data)

Displayed Errors

Err.1 - An attempt was made to store data before data was received.
Err.2 - The memory is full
Err.3 - Internal failure, return to Palmer
Err.4 - Time set incorrectly
Err.5 - An attempt was made to store data before a reference was set
Err.6 - An attempt was made to set the reference before data was received
Err.7 - MAST can’t handle data size number. Reduce logging period.
Err.8 - Printer not connected
Err.9 - No data inside MAST to print
Err.A - District selected can’t be found in the internal memory
Err.C - The reference can only be set once at the start of logging
Err.D - MAST set up to received flow data but it’s receiving pressure data (or visa versa)
Err.E - Fault on 4-20mA transducer, call Palmer to confirm error
Err.F - Receiving a reading lower than zero. Only when using 4-20mA
Err.G - Receiving a reading higher than max range. Only when using 4-20mA