

/\*\*\*\*\*

FILENAME: MICRO\_LINK MAIN.C

CHANGE RECORD:

V1.0 First release

v1.1 16/12/97

- a) Allen-Bradley protocol added
- b) Diagnostics enhanced to aid production test

v1.11 15/12/97

- a) Pulse rate calculation added

v1.2 11/02/98

- a) 12-bit analogue inputs (requires an Issue 3 or higher PCB). Earlier software versions will not work on these PCB's unless built with the issue2pcb & adc8bit defines in ML\_hard.c
- b) Supports expansion modules
- c) Adds ability to force outputs in the event of comms fail.
- d) Data\_Link TX now interrupt-driven

v1.21 04/03/98

- a) Leased line modem support added
- b) Fixes bugs with using repeaters
- c) Improved DCD diagnostics

v1.22 25/03/98

- a) Fixes bug with reading pulse rate from battery Nano\_Link o/s's
- b) Fixes bug when displaying station with more than 8 registers on DCD diag

v1.23 05/06/98

- a) Corrects help text for Modbus slave mode diagnostics
- b) Max No of digitals which can be read or written by Modbus increased from 160 to 256 for compatibility with Serck
- c) No longer forces input registers 0..3 on initialisation
- d) Test mode 248 modified to support testing expansion modules & LED display
- e) Opcodes 7 & 8 implemented so on comms error the base-station can force all digitals except outstation alarm flags.
- f) Modbus action on attempt to read data which has not yet been read via Data\_Link is now dependent on the state of DOP block 0 bit 4. If this is 1, Modbus slave responds 'slave device busy', Modbus master skips the command (same as all previous versions). If it is 0, slave and master return zero values.

v1.24 08/07/98

- a) Base-station rejects null messages
- b) If base-station tries to send data to a battery o/s (due to Bus\_Link config error) it will abort after CfgNormalAttempts, instead of waiting for the end of the window.
- c) Changes Bus\_Link RTS to always be asserted when TXing and disabled at all other times. This ensures RS485 works properly.

v1.25 20/07/98

- a) Function to force digitals and analogues on comms fail was not implemented in the outstation. It is now.

v1.26 03/09/98

- a) Using internal data transfers to local outputs on an o/s (e.g. to give a local comms fail) defeated forcing of digital o/p's. Cured now.
- b) Adds pulse output feature
- c) Bug which prevented actions on pseudo registers 3000..3100 (Data\_Link scan rate & windows) now fixed.
- d) If the base-station needs to send a data block to an outstation and request a data block from the same outstation it now sends both commands in the same scan window. It previously sent all data blocks in window 0 and requested blocks in subsequent windows. The change allows the use of battery-powered fully-equipped outstations.
- e) Previous versions misread pulses from battery o/s's if also reading analogues from them. Bug fixed.
- f) If Bus\_Link inadvertently read inputs it set BlockUsed, so a base-station tried to send controls to an outstation. Bug fixed.

v1.30 23/09/98

- a) Fixes bug which corrupted data routing tables longer than 30 lines
- b) Supports internal leased line modem
- c) Adds parameter functions to data routing table (requires DCD Config V1.30 to configure)
- d) Changes method of forcing digital & analogue outputs on comms fail so they can be configured individually
- e) Changes method of deriving flow rate from battery o/s's, to increase the capacity from 1 pulse i/p per o/s to 4.
- f) Adds BCD output option
- g) Adds pulse output option

v1.31 07/10/98

- a) Fixes bug with using repeaters (introduced in v1.30)
- b) Fixes bug with generating low battery volts alarm (introduced in v1.30)

v1.32 15/10/98

- a) Radio channels 25 & 29 were 1 frequency step too high. Error started in v1.2, now fixed.

- b) Data\_Link comms routines modified to eliminate comms errors
- c) Outstation did not clear comms fail alarm - bug fixed.
- d) Repeater functionality modified to cater for future requirement for outstations to be able to send unsolicited messages

v1.33 14/11/98

- a) Parameter 1 (force outputs on comms fail) did not work if sending and reading from an o/s using slow scan. This was because the b/s tried to send a data block first, followed by a read in the same window. If it ran out of time it aborted the read, hence didn't action a read fail. Fixed by changing sequence to read first, then send.
- b) Bus\_Link's AutoSync command (i.e. read output register 3100) did not work. Bug fixed.
- c) All Bus\_Link's scan control commands were 1 register out, because an attempt had been made to correct for Modbus starting from 1 where Bus\_Link starts from 0. Now Modbus must use actual Bus\_Link register numbers.
- d) Allen Bradley protocol modified to improve diagnostics
- e) Time-out removed from DCD Diagnostics

v1.34 27/11/98

- a) If Data\_Link b/s received a message with a CRC error it sometimes found an old reply in its RX buffer and acted on it as if it was a valid response. This bug is now fixed, and DL b/s now check that replies are from the address to which the command was sent.
- b) Data\_Link base-station now copies RSSI to input register 5 of data block for each outstation, thus recording RSSI received from each o/s.
- c) Data\_Link base-station now compatible with both old Nano\_Link s/w and versions 1.34 onwards which can return 12-bit analogues

v1.35 07/12/98

- a) Analogue inputs and outputs are now calibrated in software. This increases accuracy of analogue outputs from 2% to better than 0.5%, and saves the cost of the pot for adjusting analogue i/p's.
- b) DCD Config sometimes only allowed one upload/download after power-up. This was caused by the PC sending a NUL char when the 'Configuration upload was successful' dialog button was clicked. Bug fixed.
- c) DCD Diagnostic 'S' command enhanced to show radio frequency.
- d) DCD Diagnostic 'S' hung on some PC's after ~5mins. Bug fixed.

v1.36 19/01/99

- a) CheckDataLinkRxBuffer could give Time-Out error if another task (e.g. Bus\_Link) occupied the time between receipt of message and expiry of DataLinkMsgTimer100ms. Fixed by moving DataLinkMsgTimer100ms test from CheckDataLinkRxBuffer to Dlink\_BS and Dlink\_OS.
- b) Bus\_Link Autosync command could interrupt Data\_Link comms at any time, causing uncertain results. Fixed by only testing for Autosync during

WaitForNextWindow and WaitForNextScan.

v1.40 30/06/99

- a) DCD now uses its RTS (asserted when transmitting, cleared when receiving) so it can be accessed via a PSTN modem.
- b) Alphanumeric display routines added
- c) Battery volts now scaled so 0..20V = 0..16000, for compatibility with Nano\_Link scaling
- d) Calibrate I/O test mode (add 248) didn't work properly for testing analogue input expansion modules - bug fixed
- e) Test radio TX (add 250) was deleted in V1.35, since the test was incorporated into Test Mode 248. Now re-instated to simplify field adjustment of TX power.
- f) RSSI now calibrated over range -15dBuV...+25dBuV
- g) Average flow rate calculation at the base-station now works with both Nano\_Link and Micro\_Link outstations (previously only Nano\_Link).

v1.41 02/08/99

- a) DCD diagnostics enhanced to improve response to S & I commands
- b) LOW\_VOLTS\_ALARM changed to restore original level before (c) above.
- c) Alphanumeric display routines enhanced for compatibility with v1.00 display software

v1.42 10/12/99

- a) Diagnostics did not display OR, IR, OD, ID or ? correctly. Corrected by changing column widths & text formatting.
- b) Modbus CRC calculation did not kick watchdog, so software could reset if generating a long message. Fixed
- c) There was no 'Complete System Fail' alarm from the base-station. Implement using Bit 4 of alarm flags.
- d) DCD diagnostics modified to show complete and partial comms fail.
- e) Bus\_Link slave digital & analogue accesses had various errors confusing input and output. Fixed
- f) Bus\_Link comms fail alternated between ON & OFF when actually ON in master mode. Fixed
- g) Hardware I/O fail alarm doesn't work. Fixed
  - h) Battery volts measurement accuracy improved
  - i) Low volts alarm changed from 10V to 10.5V

v1.43 16/02/00

- a) If the configuration data read from NOVRAM is corrupted (say by a mains glitch) a default config is generated and written to NOVRAM. This can delete a good config. Should try several times before aborting. FIXED
- b) Option added to read retry count for each outstation from input register address 2500 + o/s address. Value overflows at 255.

- c) Option added to read CRC error count for each outstation from input register address 2750 + o/s address. Value overflows at 255.
- d) Config programme modified in accordance with Motorola Technical Data M68HC11CFG/D to work with 68HC11E0 processors.
- e) Modbus Force Coils command didn't work with expansion modules
- f) DCD Diagnostics 'cmd:' & 'rep:' now 'cmd: ' & 'rep: ' to improve clarity

v1.44 18/02/00

- a) v1.43(a) caused a problem if NOVRAM data is invalid. Bug fixed.

v1.45 31/08/00

- a) Scaling Micro\_Link internal analogue inputs did not work. Bug fixed

v1.46

- a) Base-station returns uncalibrated RSSI to outstation, so a display at a Nano\_Link outstation shows the wrong value. Fixed.
- b) If uploading a large config to DCD the data repeats every 30 lines. Fixed.

v1.47

- a) The watchdog timed out at initialisation if the data routing table had more than ~100 entries. This caused the base-station to hang after loading the config. Fixed.

v1.48

- a) The fix in V1.47 prevented the watchdog timer from resetting the CPU after a DCD config download. This can cause problems. Fixed.

v2.00 01/11/00

- a) Exception reporting added
- b) Response to DCD command "Send Product ID" now returns VERSION\_NO. All previous issues returned Version No = 1.
- c) DCD diagnostics ID, OD, IR, OR, FC, FD, FH & FR commands now apply to inputs/outputs, independent if the point is local or remote. This eliminates the need for the user to be aware that inputs and outputs are reversed for remote I/O.
- d) Now uses page zero RAM, address range 0x40..0xFF (in 68HC11), for fast access.
- e) On comms fail the base-station cleared the o/s -> b/s RSSI (i.e. input reg 5) for all o/s's but only cleared the b/s -> o/s RSSI (i.e. output reg 5) for battery-powered Nano\_Link o/s's. Now also clears the b/s -> o/s RSSI for mains-powered o/s's.

v2.01

- a) Base-station returned uncalibrated RSSI to outstation, so a display at a Nano\_Link outstation showed the wrong value. Fixed

- b) DCD 'S' command displayed uncalibrated RSSI. Fixed

- c) If uploading a large config to DCD the data repeated every 30 lines. Fixed

- d) ADC routines modified to read either the existing MAX186 or the new MCP3201 chip, as used on issue 4 PCB's and later. Earlier software versions cannot be used with the new PCB's.

- e) Checks the software version of DCD Config to allow it to be configured from versions prior to v2.00. Note that with old versions of DCD the Scan Window for Normal and Low Power outstations is the same, and the Scanning Period will apply only to Low Power outstations. Normal outstations will be scanned continuously at the Scan Window rate.

- f) DCD 'S' command did not report Data\_Link comms fail alarms correctly. Fixed

- g) Mitsubishi protocol implemented.

- h) Supports battery-powered repeaters

V2.02 20/04/01

- a) Mitsubishi protocol used all hex addressing. Changed as follows:

D reg: Decimal

X, Y reg (FX PLC's): Octal

X, Y reg (non-FX PLC's): Hex

This matches Mitsubishi spec. The first command sent to the PLC is now Read D8001. If the return value is 20000...29999 it is an FX. Any other value is non-FX.

V2.03 29/05/01

- a) Base-station scanning bugs fixed
- b) V2.0x outstation was not compatible with V1.xx base-station. Fixed by modifying protocol as per Message Protocol V3.2. Note that V2.00..2.02 are not compatible with either V1.xx or V2.03.
- c) Now supports battery-powered repeaters
- d) Maximum number of digitals which can be transferred via a line entry in the Data Routing Table or via a Bus\_Link command increased from 256 to 1024

V2.04

- a) Modbus slave would not accept commands to read registers or digitals starting from address 0. Bug fixed.
- b) V2.03 base-station was not compatible with V1.xx outstation. Fixed by reverting to original protocol as per Message Protocol V3.3. Now believed to be compatible with all combinations of previous software, except V2.03.
- c) V2.xx did not work as a repeater. Bug fixed.

V2.10 31/08/01

- a) If reading from and writing to an o/s, V2.xx b/s does write, then read.

It doesn't update the o/s RSSI until it reads from it, so it sends to the o/s the old RSSI level. Sequence changed to read then write.

- b) Nano\_Link o/s's no longer use Scan Rate, so it is no longer appended to Micro\_Link b/s commands.
- c) Earlier versions would not allow Modbus master mode to write to multiple slave registers. When this was fixed the fix would not accept transfers from outstation 30 or above. Bug fixed.
- d) Base-station scan sequence modified to stop it interrogating outstations which don't exist.
- e) Revert to Message Protocol V3.2 for compatibility.

v2.11 18/09/01

- a) Transmit test mode modified so transmitter sends constant carrier if all digital inputs are open. This assists on-site commissioning, allowing the user to easily set transmit power level.
- b) Outstation sent digital inputs 1..16 twice instead of sending 1..16, 17..32. Fixed.
- c) Base-station didn't give summary of scan of mains o/s's. Fixed.

v2.12

- a) V2.03 increased maximum number of digitals which can be transferred via a line entry in the Data Routing Table or via a Bus\_Link command from 256 to 1024. This is still not enough, so limit increased to 1968.
- b) One customer reported extra outstations being added to the poll, even though they are not in the data routing table. Believed to be caused by base-station picking up messages from another system and treating them as exception reports. Fixed by adding further checks to processing of exception reports.
- c) Exception reporting didn't work for Micro\_Link outstations. Fixed.
- d) Common comms fail alarm didn't work. Fixed.

v2.13 10/01/02

- a) RSSI at an outstation was updated even for messages not addressed to the outstation. Fixed
- b) Mitsubishi A1S PLC's do not conform to the instruction described in V2.02(a). They respond with NAK, since D8001 is not implemented. Modified so NAK is also interpreted as non-FX.
- c) Hardware fail alarm did not work properly. Fixed
- d) Watchdog timer lapsed during initialisation if there were more than 13 expansion modules, preventing the system from starting. Fixed
- e) When set to CAL\_IO test mode, if digital inputs were set to 01xxxxxx to test outputs with RSSI on output 1 the software would reset. Fixed

- f) When set to CAL\_IO test mode, if digital inputs were set to 1xxxxxxx, DCD diagnostics would display the calibrated analogue input values instead of the raw value. Fixed
- g) Digital exception reporting from Micro\_Link o/s's had errors. Fixed

v2.14 19/02/02:

- a) Reproducing count outputs at a b/s only worked for the 8 outputs on Micro\_Link, not on the first 8 expansion outputs. Also pulses could be missed if there were lots of expansion modules. Fixed
- b) Outstations didn't save counts through a power down. Fixed
- c) Decimal point did not work on digital display module. Fixed

v2.15 12/03/02:

- a) Outstation did not support more than one repeater in a chain. Bug introduced at v2.00. Fixed.

v2.16 18/03/02:

- a) If Bus\_Link is set to RS485, RTS on delay must be >= 20ms. Software now ensures this.
- b) There was a problem when using a Sipex SP485 instead of a Maxim MAX485 in IC20. In the quiescent state the RXD output is indeterminate, so the Bus\_Link LED could light green. This is equivalent to receiving a constant break character, which corrupted Bus\_Link comms. Fixed.
- c) Initial calibrating of analogue outputs failed if there was random data in EEPROM. Fixed.

v2.17 28/03/02:

- a) The fix introduced by V2.13(d) negated the fix introduced at V1.47(a), so the watchdog timed out if more than ~100 lines in the data routing table. Fixed.
- b) Outstations did not return their RSSI to the base-station. Bug introduced by V2.13(a). Fixed.

v2.18 29/05/02:

- a) When calibrating RSSI, analogue output 1 showed the corrected RSSI value, not the raw value. Bug introduced by V2.13(a). Fixed.
- b) In Test modes DCD Diagnostics did not display corrected RSSI value. Bug introduced by V2.13(a). Fixed.
- c) If DCD Diagnostics monitored a Bus\_Link command of more than 255 characters it would truncate the displayed message. Bug has always been there! Fixed.
- d) Base-station V2.03 or later would not report Micro\_Link outstations earlier than V2.03 as being Nano\_Link. Fixed
- e) Base-station V2.03 or later would not process data from expansion modules on outstations earlier than V2.03. Fixed
- f) When calculating average pulse rate, b/s sent data block to o/s as well as reading from it. Fixed.
- g) Makes provision for using satellite communications link by allowing extended

message transmission delays of up to 20 seconds. This uses the field in DCD originally provided for RTS/CTS off delay, but renamed in DCD V2.11 as 'Transmission Delay'.

- h) If the base-station fast scan window is not zero, then the Retries field is not now used. Instead the b/s continues retrying for the duration of the window, but the last attempt uses an extended lead-in.
- i) Diagnostics at a repeater displayed the wrong outstation address for messages to be forwarded from the b/s. Fixed.
- j) A Micro\_Link o/s repeating to a battery-powered Nano\_Link o/s could time out when sending a extended retry. Fixed.
- k) DCD Diagnostics did not show Data\_Link comms on 'D' command if using only low-powered o/s's (had to use 'L' command). Fixed.
- l) Complete comms fail alarm didn't always work. Fixed

v2.19 05/11/02:

- a) DataLinkBuffer now shared between TX & RX to save memory
- b) Mitsubishi protocol would only work if the first Bus\_Link command in the data routing table was a write to Bus\_Link. Now works with both read and write.
- c) If invalid data is read from NOVRAM after a reset, default data is still put into RAM, but the NOVRAM is no longer cleared. This means that if the problem was caused by a transient, the original config can be restored by a further reset.
- d) For test purposes it is sometimes useful to be able to continuously scan battery outstations. If the Low Power Outstation Scan Rate was set to 0, the software replaced the value with 60 secs. This has now been deleted, so the b/s can scan continuously.
- e) An outstation set it's comms fail delay as being the scan rate (derived from two consecutive scans) plus a safety margin of 2 minutes. The safety margin is now defined by the value of Normal Outstation Scanning Window in the configuration downloaded to the outstation.
- e) When receiving a Preset Multiple Registers command (Function Code 16), Modbus slave routine only updated the first register. Fixed.
- f) If there was only one outstation the base-station did not flag Complete Comms Fail. Furthermore, it waited a Scan Window before polling again. It did, however, correctly flag comms fail for the outstation. Fixed.
- e) In comms test mode the Test LED did not indicate RSSI fail condition. Fixed.
- f) Adds Mains Fail Alarm as Alarm Flag 5

v2.20 12/12/02

- a) Ref 2.13(b): When Mitsubishi sends NAK, some versions do not append a Checksum, so BusLink could give Checksum Error. Fixed
- b) Bus\_Link master comms could not be set to less than 1 sec scan rate. Now allows continuous scan.
- c) V2.19 introduced basic PSTN/GSM communications, which caused problems with leased line operation. In particular, it only allowed 20ms for the transmitter to stabilise, whereas the internal modem needs 40ms. Fixed
- d) Basestation could try to interrogate o/s 0 if there was a comms failure during initialisation. Fixed.
- e) Data\_Link diagnostics did not display 'O.K.' for all valid messages. Fixed

v2.21 10/01/03

- a) Time added before 'cmd:' and 'rep:' in DCD diagnostics
- b) Transmitter test mode (address 250) didn't work. Bug introduced at V2.19. Fixed.
- c) Mains Fail Alarm added to Station diagnostics

v2.22 26/02/03

- a) Leased line modems can give spurious data before start of message that can be read as 0x01, 0xFF. This could be falsely interpreted as the start of message, resulting in CRC errors. Fixed by deleting data received so far if there is a break in transmission > DataLinkTimeout5ms.

v2.23 03/04/03

- a) B/S count output pulse rate was only ~1pps, now ~3pps (may be slower if lots of I/O expansion).
- b) B/S told low power o/s to wake up at end of scanning window instead of beginning. Bug introduced at V2.18. Fixed
- c) Support added for Initiation Delay at o/s's.
- d) Pulse count outputs now cleared each time configuration is updated

v2.24 24/04/03

- a) Time added in v2.21 was not correctly displayed after 9.1 hours (because it used signed integers instead of unsigned). Corrected, and modified so it displays a 12 hour clock (00:00:00...11:59:59).
- b) Mitsubishi protocol enhanced to show diagnostics when in slave mode.
- c) Bugs fixed in Initiation Delay support.
- d) An o/s could latch in a state with the radio TX on, from which it could not recover. The cause of the latch-up is unknown, but the recovery failure was introduced at v2.19, when the radio config routine was brought into line with that of Nano\_Link. It would appear that the bug has always existed in Nano\_Link, but Nano\_Link does not suffer from the latch-up, so never has to recover from it.
- e) Mains Fail alarm can now be returned from a low-power outstation

v2.25 26/08/03

- a) DCD Diagnostics did not report on 'D' if all battery o/s's (only on 'L'). Fixed
- b) When acknowledging an exception report, the b/s used extended retry if the last command to the o/s used extended retry. Fixed
- c) Allows copying digitals to analogue registers (as needed by Essex & Suffolk Water). If source is digital and destination is register, copies the digital to the bit in the destination register defined by Quantity.
- d) Allows copying register-register in a b/s without initiating polling of o/s's, by adding 10,000 to the register address (as needed by Essex & Suffolk Water).
- d) Exiting diagnostics sometimes caused processor to reset. Fixed
- e) Only supported 15 output pulse counts max (should be 16) (ECE Systems). Fixed
- f) Exception reporting was not implemented for sending changes to outstations. Fixed.
- g) When o/s sent an exception report it always identified it as coming from Nano\_Link o/s. Fixed.
- h) Did not recognise radio if set to channel 13. Bug introduced at V2.24. Fixed
- i) After downloading a new config, Micro\_Link now does JMP \$C000 instead of waiting for a watchdog reset. This is slightly quicker, and allows debugging on the iSystems emulator (which does not support the watchdog).
- j) Base-station did not correctly flag partial comms fail. Fixed

V2.26 02/07/04:

- a) If exception reporting is enabled on a battery o/s, the b/s would occasionally start scanning it as a normal o/s, thus running the battery down. Fixed
- b) Allen-Bradley protocol modified so it fully implements slave mode unprotected read and unprotected write commands. These now pass data as 16-bit binary values. All previous versions (from V1.10) implemented the variant used by RAF St Athan, which sent values in BCD spread over 32 bits.

V2.27:

- a) 'Complete Comms Fail' is erratic. Sometimes comes on but will not go off - sometimes vice versa.
- b) 'Mains Fail Alarm' does not work, either when read locally or from an outstation.
- c) 'Buslink Fail' is erratic.

V3.00: 02/08/05:

- a) Re-written to use structures & I/O streams, in line with GSM\_Link & Nano\_Link
- b) Dual Comms added
- c) User accessible watchdog alarm flag added
- d) Diagnostic displays improved
- e) Works with original 24LC65 or 24LC512

V3.01 17/08/05:

- a) Assumed Dual Comms fitted, even if it wasn't. Fixed
- b) Test mode now flashes leds in sync when required.
- c) Watchdog alarm flag now doubles as External Comms Fail when fitted with dual comms.
- d) Calibrating analogue o/p's did not work properly. Fixed.

V3.02 14/11/05:

- a) If an O/S was configured as a Bus\_Link slave it would read/write input regs & digitals instead of output regs & digitals, and vice versa
- b) Exception reporting previously used an 8-bit value that was shifted left by 4 bits, giving a range of 0x0010...0x0FF0, or 16...4080, or 0.4%..100% for 12-bit analogues. However, some users map 16 digitals into a register accessed via Bus\_Link, and need exception reporting on any digital change. The value has therefore been changed to 12 bits, giving a range of 0x0001...0x0FFF. Fixed in V3.03
- c) Digital Value on Comms Fail didn't work properly. Bug introduced at V3.00. Fixed in V3.03.
- d) Mitsubishi handler not working correctly. Fixed in V3.03  
NB V3.02 only released to Norman Fisher - 3 Valleys for Dunstable dual comms system.

V3.03 21/12/05:

- a) BusLink comms transmitted erroneous characters at end of transmission. Fixed by introducing separate Tx and Rx buffers.
- b) DCD diagnostics at outstation incorrectly showed messages for output expansion modules as for Bus\_Link. Fixed
- c) Problems occurred when CRC errors received from expansion comms. Fixed.
- d) Modbus ASCII support removed
- e) Allen-Bradley module removed from project pending further development
- f) Command and Replies reformatted on DCD diagnostics to mirror previous software releases
- g) Code could get stuck in loop in certain instances of Dual Comms Fail. Fixed.

V3.04 Not Released

- a) DF1 protocol added
- b) Bus\_Link Master scanned continuously regardless of scan interval set in DCD. Fixed.
- c) Modules reshuffled into different banks, to make space in Common Area for more variables.
- d) FC command from DCD diagnostics didn't work. Bug introduced at V3.02. Fixed.
- e) Timing problem affecting Bus\_Link when expansion modules fitted. Fixed

v3.05 31/05/06:

- a) v3.04 would not compile into an EPROM correctly. Project re-structured as required, without changing functionality
- b) RSSI test mode inoperative - Fixed.

v3.06 21/08/06

- a) Enhancements to Allen Bradley and Mitsubishi routines after testing at MCS
- b) In CAL\_IO test mode Micro\_Link did not sequence analogue outputs on expansion modules. Fixed.

v3.07 10/11/06

- a) Setting O/S comms fail timer to 60 secs initially can produce continuous comms fails on large systems. Fixed by setting to 30 minutes.
- b) Use of batt-powered flowmeters & associated pulse-rate calculation doesn't work as it did in V2.27. Fixed & improved.
- c) Initialisation of No Analogue Outputs in test.c fixed.
  - d) Diagnostics improved so D & L modes work as intended
  - e) Diagnostics now shows all times in Hours/Minutes/Seconds
  - f) Diagnostic displays for IR, ID, OR & OD corrected
  - f) Count replication at b/s corrected

v3.08 19/01/07

- a) If Normal Scanning Window is greater than 0 but less than 10 it is forced to 10 seconds.
  - b) Slow Scan timing modified to eliminate possible errors with calculating pulse rates.
  - c) Data\_Link Base-station timing changed
  - d) NLpointsUsed[] changed to simplify coding
  - e) Diagnostics for S, ID, OD, IR & OR updated
  - f) The outstation Comms Fail alarm detection assumed that its Normal Outstation Scanning Window was the same as that at the b/s. If it was less (or 0) the o/s would raise random comms fail alarms when in normal operation. Fixed, provided both b/s and o/s use new software
  - g) Battery volts are calibrated so that  $0.4000 = 0.5V$ , so Micro\_Link typically gives reading of 9600 for 12V. In V2.xx, if Micro\_Link battery volts are copied to an analogue output the user must apply multiplier/divider. V3.00..V3.07 divide battery volts by 4 to keep it in range 0..4000. Software now changed back for compatibility with V2.xx.
-