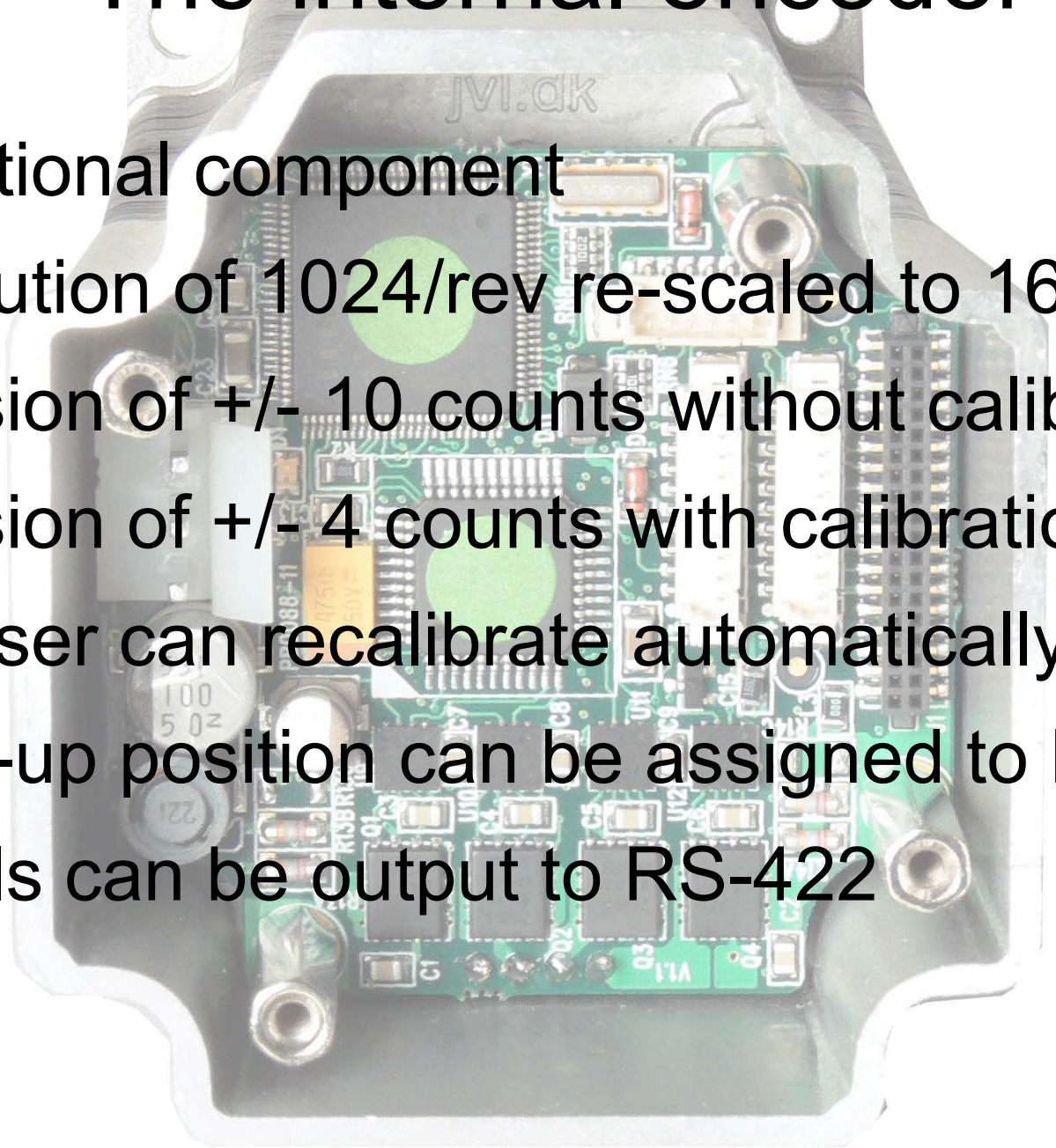
Using sensors with SMC75

- Internal single-turn absolute magnetic encoder
- External incremental encoders
- External SSI encoders, absolute multi-turn
- Other external SSI sensors
- Flash-based absolute multi-turn encoder
- Internal, external and SSI are separate and can all be used at the same time




The internal encoder



- An optional component
- Resolution of 1024/rev re-scaled to 1600/rev
- Precision of +/- 10 counts without calibration
- Precision of +/- 4 counts with calibration
- End user can recalibrate automatically
- Wake-up position can be assigned to P_IST
- Signals can be output to RS-422

External incremental encoders

- Use Inputs 1 and 2 (only)
- Pulse/direction or A/B Quadrature signals
- Updated every 30/100/xxx micro-seconds
- 32-bit incremental count in register 170
- Velocity in register 172
- Value can be saved and restored from flash
- Some encoders are both absolute SSI and incremental
- The value is not used by firmware

Absolute SSI encoders

- Can be either single-turn or multi-turn
- Can be combined with incremental operation
- Communications speed up to 600kHz (SW)
- Up to 32 bits of data
- Does not know about the data format
- Binary and Gray codes
- Checksums, status bits, etc.
- Registers: 32-bit data, 2 x 16-bit setup

Absolute SSI encoders (cont.)

- Uses the RS-422 dual differential 5V signals
- What can be configured ?
- Clock speed: 10 to 600 kHz in steps of 10kHz
- Number of data bits: 1 to 32
- Prepare time: 1 to 256 micro-seconds
- Count can be saved and restored from flash

SSI operation principles

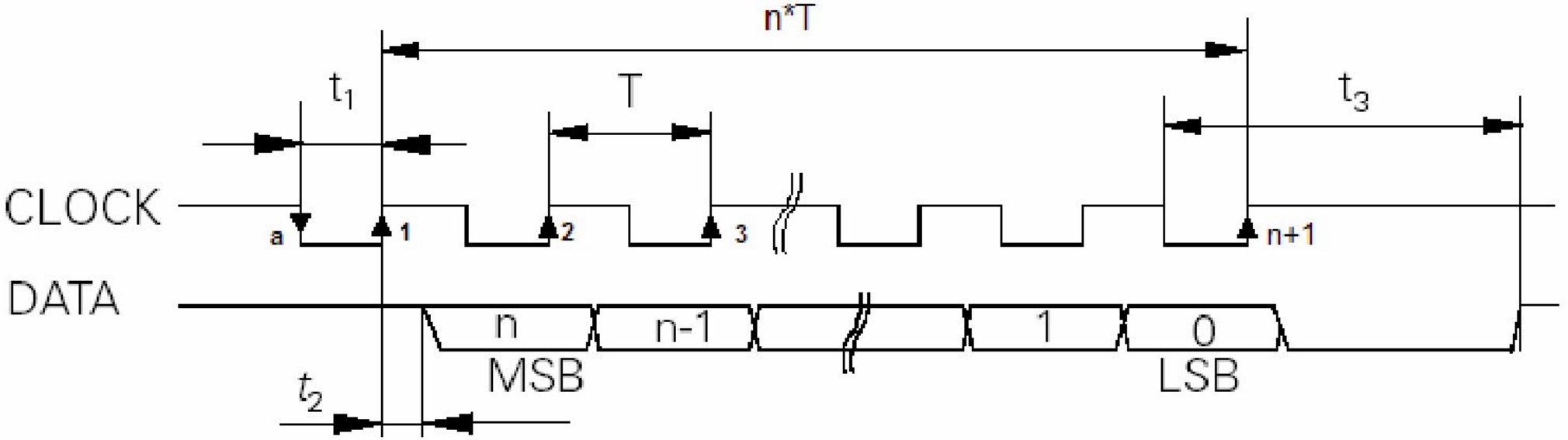
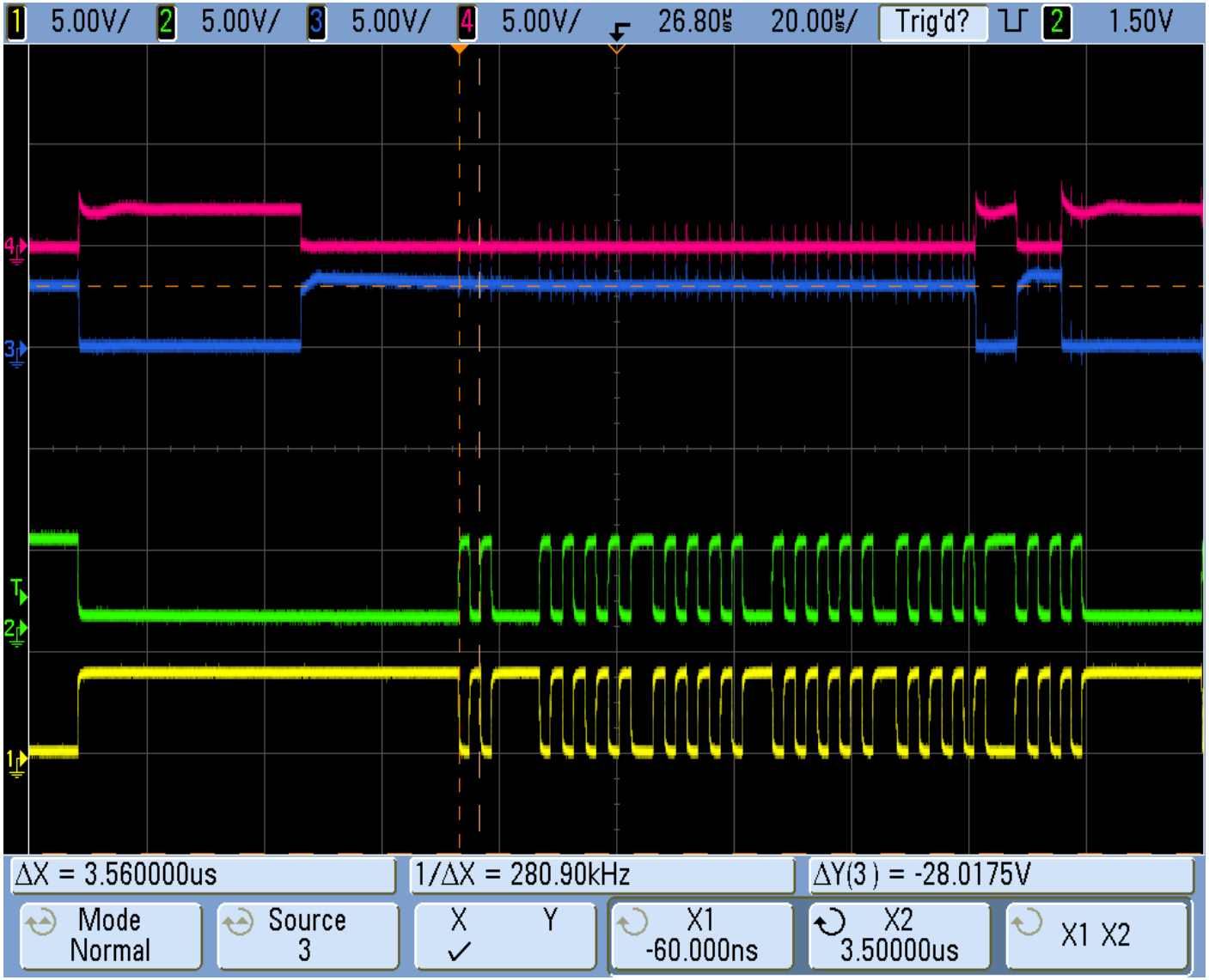


Figure 1 – Typical SSI Timing Diagram

n = total # of data bits
T = clock period (sec)
1/T = clock frequency ~500kHz to ~2.5 MHz (set by sign of p argument of SI command*)
t_1 = minimum time required for encoder to freeze data and prepare shift registers before receiving the first rising edge to prompt the MSB
t_2 = data transmission delay (increases with cable length)
t_3 = required delay to refresh position data between subsequent position reads.

Absolute SSI encoders (cont.)

- Example of data format:



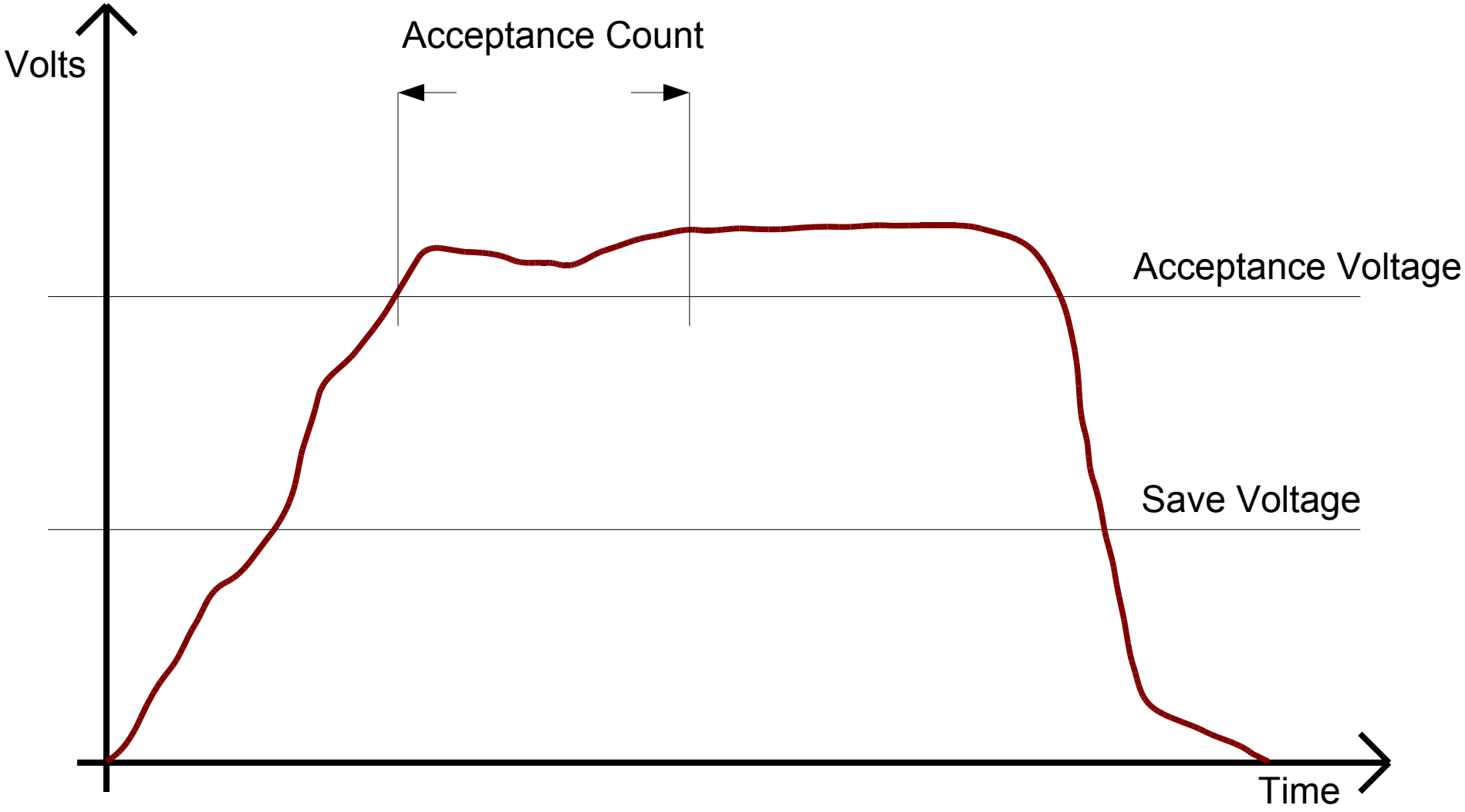
Other external SSI sensors

- SSI are also used to measure temperature
- For absolute multi-turn encoders:
- first read the absolute value through a command 321 to the Command register
- afterwards use the incremental signals for high-speed updates.

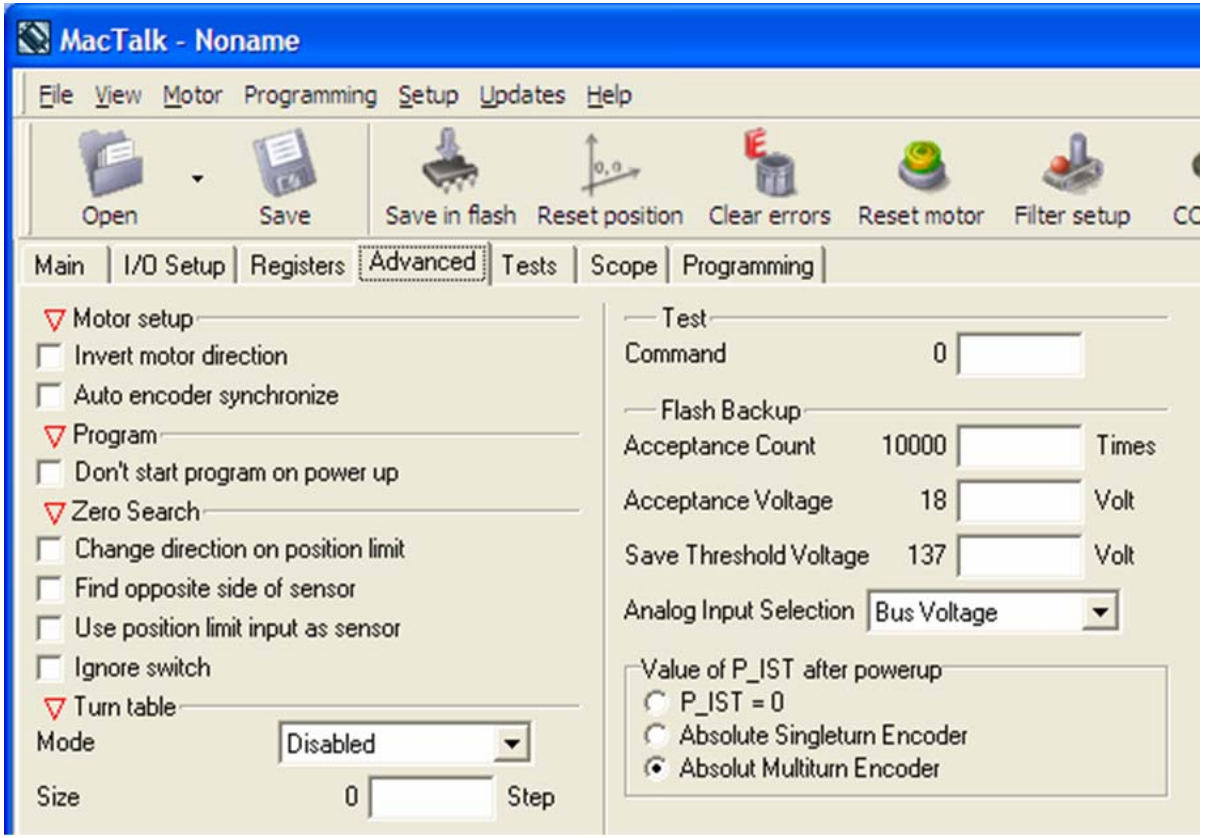
The Flash Backup System

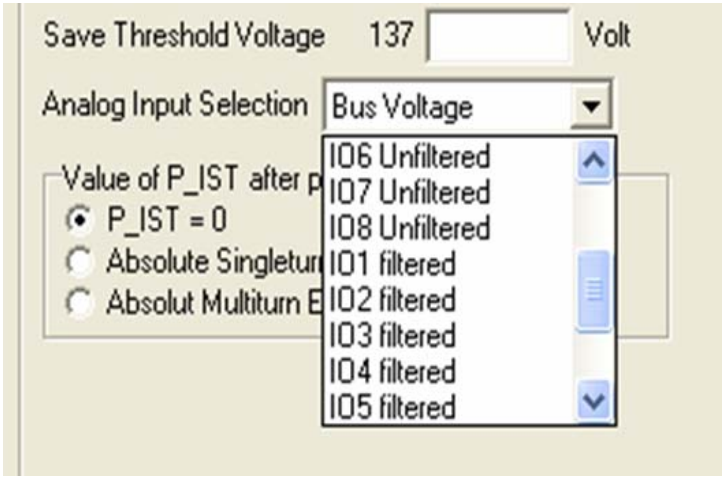
- The Control Voltage (CV) must be measured
- The control voltage must fall slowly
- Turn on/off on the AC side of the power supply
- Thresholds for power good and flash save
- Operation will stop, and data is saved in < 5ms
- Saves: P_IST, 3 x EncoderPos, Turn-offs, RunSeconds, Plc Program uploads, SaveInFlashCount, Error counters and times

The Flash Backup System (cont.)



FBS in MacTalk





Internal flash-based absolute multi-turn encoder

- Builds on the Flash Backup System (FBS)
- General concept is to save a set of the actual position (P_IST) and the internal encoder position
- This allows the firmware to reload and modify P_IST up to +/- 180 degrees at power up

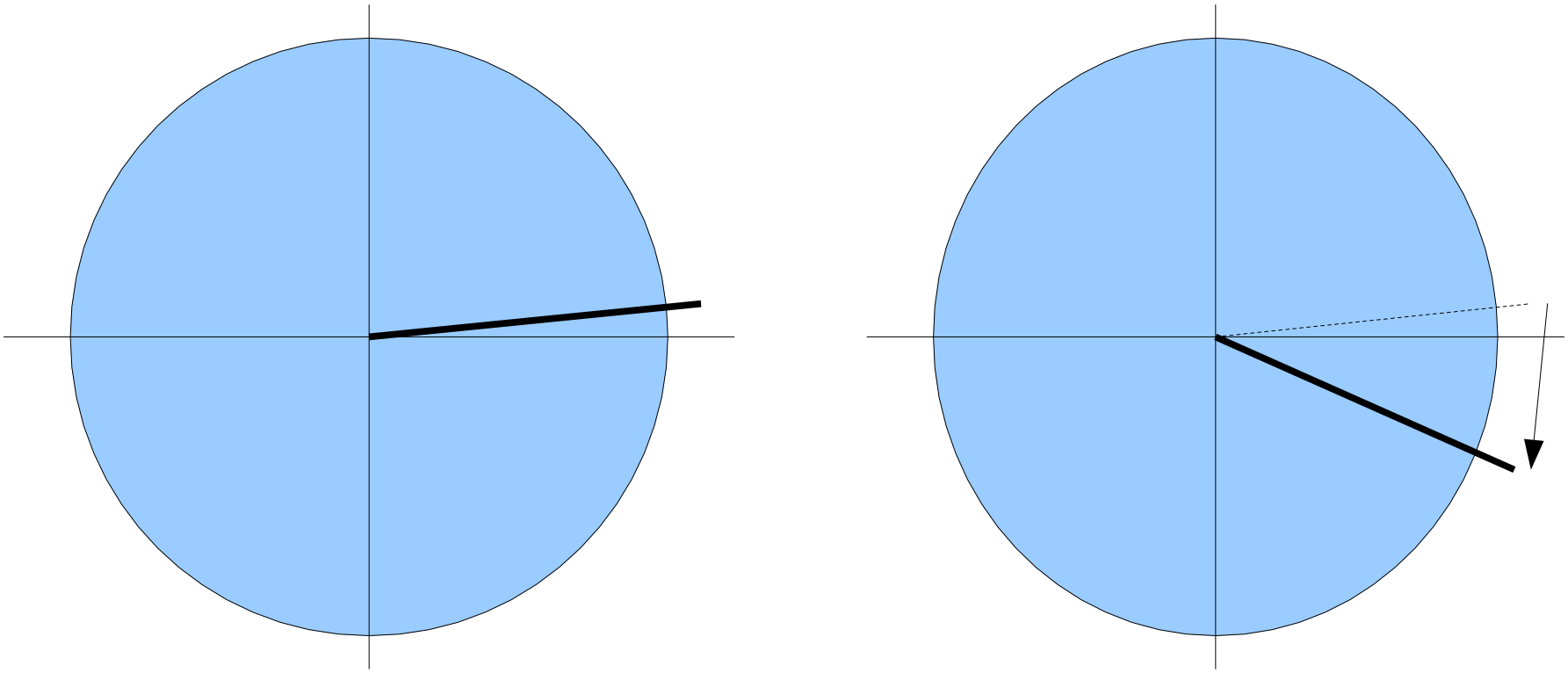
Example of flash based encoder

Saved values

P_IST = 10000, Enc = 380

Wake-up values

P_IST = 10120, Enc = 500



Result: P_IST = Saved P_IST + (New EncPos - Saved EncPos)