Robot Arm, Beckman Coulter Orca

ORCA: Optimized Robot for Chemical Analysis;

- 5 (6) Axes; [1] Longditudonal motion along rail, [2] 1st lat. joint, [3] 2. lat. joint, [4] 3. lat. joint, [5] 1. rotational joint, [6] 1. Finger/Gripper.
- Almost certainly 24V power supply
- <5MBit RS485 multidrop bus to all three control boards.
- Axes [1,2], [3,4] and [5,6] have their own control boards with differing layouts but nearly i
- dentical components.
- There is a separate 2-board (probably) inclinometer board attached to the 2. lateral joint. Every joint consists of a brushed DC motor with axles protruding from both ends, with significant gear reduction on one side and a Honeywell glass disk encoder on the other.

Motor Control Board Guts:

- MC68HC711E9CFNE2: MCU, 8BIT 12KB OTP ROM 2MHz 52PLCC
- L4960: Switchmode controller, 2.5A 9-46Vin 5V Out
- SN75176A: Differential Bus Transceiver
- DA05P: ESD Protection Diode Bridge
- 74HC4538: Dual retriggerable precision monostable multivibrator, probably for RS485 /something timing alignment
- LMD182003A: 55V H-Bridge
  - Inputs: Direction, Brake, PWM
  - Outputs: Thermal flag, Analog current sense
- 82C54: CMOS Programmable Interval Timer
- TL7705ACP: Voltage Supervisor
- HCTL2000: 12/16-bit Quadrature Decoder/Counter

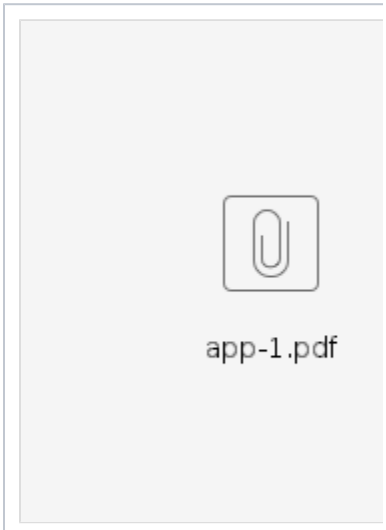
125000, 62500,

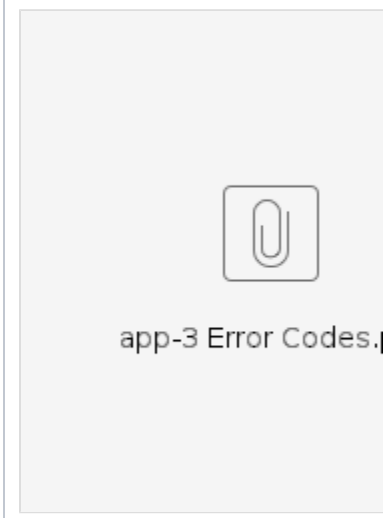
Hints to comms protocol:

- Supposed to have Force and Torque feedback for at least fingers, maybe all joints. Video online of the robot painting and moving batteries corroborate this, Each 2-joint motor control board probably runs a PID-ish control loop, possibly with full motion control loops but perhaps just point-to-point with motion parameters.
- 4 near identical modules communicating via a <2MBit RS485 multidrop bus
- MCU has one UART (SCI):
  - Datasheet §7.3; NRZ signaling, simple data format: Idle high, start bit 0, 8/9 bit packet LSB first, stop bit 1, break period of 0-bit strings for at least 1 frame.
  - Datasheet §7.1 Table 1; Baud rate table: 8MHz Crystal 2MHz Bus. There are 32 possible rates, but something really standard,
  - Probably means multi-packet instructions, 8 bits for both operation bits and data bits seems insufficient.

Inspiration:

- Martijn Berntsen's YouTube and GitHub sites





Control Box DB-15 Connector

Pin	Connection
1	GND
2	DP/DN
3	GND

Bilder av de ulike kretskortene i robotarmen og hvordan de skal/ er koblet opp.

4	VA
5	VA
6	VA
7	VA
8	NC
9	DN/DP
10	GND
11	GND
12	VB
13	VB
14	VB
15	VB

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