Curtis controller manual 1238

1 1 1 1 234/36/38 Manual and 1238 M O D E L S AC INDUCTION Motor Controller OS 11 and VCL 2009 Curtis Instruments, U.S. Patent NO /36/38 Manual, p/n February 2009» Software Version OS 11.0 [CURTIS Instruments, INC. The design of the Curtis PMC 1200 series controller protected by 200 Kisco Avenue Mount Kisco, New York USA Telfax 2 3 Content Content 1. Overview installation and wiring... 3 Equipped with controller... 3 high current connections and wiring guidelines... 6 low current connections and wiring guidelines... 8 controller wiring: basic configuration ... 12 Switch input wiring... 13 throttle wiring... 13 input/output specifications programmable parameters... 23 Program Menu a. Controller Information Menu Initial Set Guide Vehicle Control Language Diagnosis and Troubleshooting Maintenance Appendix A Appendix B Appendix C Appendix C Appendix C Appendix D Operating Vehicle Design Considerations Programmer's Theory of Operational Specifications, 1234/36/38 Controller Curtis 1234/36/38 Manual, OS 11 iii 4 Figures / Table Figures 1: 123, Curtis 1233. 1 degree. 2a: mounting dimensions, Curtis 1234 controller... 3 degrees. 2b: mounting dimensions, Curtis 1236/38 controller ... 4 degrees 3: Basic wiring figure 4: wiring diagram for type 1 throttle 5: wiring diagram for type 2 throttle 6: Wiring diagram for type 3 throttle 7: acceleration response speed diagram 7: braking response speed diagram diagram diagram. 9: Throttle mapping, torque control mode Road 10: Smooth ingesting effect parameters of gears, torque control mode 11: effect of brake taper speed parameters, torque control mode Map 12: Drive current limit map Map 13: Rezen current limit map Map 14: Throttle Adjustment Map 15: VCL Command Motor 16: VCL Processing Mode. A-1: Painting. A-2: IFO diagram... A-2 Power Section Topology... A-3 getaway. C-1: Curtis 1311 Handheld Programmer... C-1 Table Table 1: High Current Connection... Table 6 2: Low current connection... Table 9 Table 3: Programmable Parameters Menu Table 4: LED Display Table 5 Types: Troubleshooting Chart Table D-1: Specs, 1234/36/38 Controller... D-1 iv Curtis 1234/36/38 Manual, OS 11 5 1 Overview 1 Overview Curtis 1234, 1236 and 1238 AC induction motor controllers provide smooth power unlike previous vehicle control systems. It offers unprecedented flexibility and power, including on-site programmable logic controllers built into state-of-the-art motor controllers. The embedded logic controller runs a fully functional field-oriented AC motor control operating system (OS) that can be customized through parameter modification. See Section 3. The OS also includes logic to run OEMdeveloped software called VCL, which can be used to improve controller functionality beyond the basics. See Section 7. Vehicle control languages (VCL) A software programming language developed by Curtis. Many electric vehicle features are uniquely built into the VCL code and can be used to control the add-on suppoks oem. VCL opens up new avenues for customization, product differentiation and market responsiveness. Included in CAN bus communications and many other Curtis products included in 1234/36/38, these AC-induced motor controllers can be part of an efficient distributed system. Input and output can create integrated features that minimize wiring and reduce system costs throughout the system through optimal sharing. The Curtis 1234/36/38 controller is the ideal solution for traction, hoist, dual drive and other motor drive and vehicle control needs. Figure 1 Curtis 1234 (left), 1236 (medium), and 1238 (right) AC-induced motor controllers. All three models have the same standard features. Like all Curtis controllers, the 1234/36/38 provides excellent operator control over motor drive performance. Features: High efficiency, field-oriented motor control algorithm advanced pulse width modulation technology advanced pulse width modulation technology for efficient use of battery voltage, ultra-wide torque/speed range including low motor harmonics, low torque ripple, and full playback functions, With a very wide torque/speed range, including smooth low-speed control with full playback functions including zero speed Curtis 1234/36/38 manual, OS 11 1 6 1 OVERVIEW control algorithm adapts the view to motor temperature changes to maintain optimal performance on real-time battery current, motor torque and power estimation power limit maps, enabling performance customization for motor heating and consistent performance in a variety of battery conditions and powerful operating systems, enabling vehicle control operations, motor control and over-configurable configuration of over-the-clock configuration. Internal battery status charging, timemeter and maintenance timer for maximum distributed system control, can easily communicate with curtis 1311 handheld programmerand other CAN bus support system components that can be programmed via 1314 PC programming station CAN bus connection; The protocol meets the CANopen standard. Other 11-bit identifier field CAN protocols can be customized through VCL field programmable, flash downloadable main operating cord heat shut-off, warning and automatic shutdown provide protection for motor and controller robust sealed housings, and connectors meet IP65 environmental sealing standards for use in harsh environments, providing excellent heat transfer for increased reliability in typical drive vehicles and dual-drive vehicles. Note: If you have a dual drive application, see the Dual Drive Appendix. 1234/36/38 Manual, Part Number DD. Getting used to the Curtis controller will help you install and operate properly. We recommend that you read this manual carefully. If you have any questions, please contact the nearest Curtis office. You can use the 1311 handheld programmer to set up a controller to perform all the basic tasks. This guide first shows you how to connect your system and adjust its performance characteristics without using a VCL. Section 7 will then show you how to adjust your system using a VCL that interacts with a second independent software area on a powerful logic controller built into the 1234/36/38 controller. 2 Curtis 1234/36/38 Manual, OS 11 7 2 Installation and Wiring 2 Installation and Wiring Mounting Controller 1234 For Controller 1234 Contour and Mounting Hole Dimensions are shown in Figure 2a, and also for 1236 and 1238 controllers of 2b. These controllers meet IP65 requirements for environmental protection against dust and water. Nevertheless, to ensure that external corrosion and leakage paths are not developed, mounting locations must be carefully chosen to keep the controller as clean and dry as possible. The controller recommends using the provided holes to secure four 6 mm (1/4) diameter bolts to a clean, flat metal surface. Thermotrillion compounds can be used to improve the thermal conduction from the controller. Millimeter (and inch) Curtis 1234/36/38 manual, OS 11 3 8 2 installation and dimensional mounting surface of the wiring heatsink. Additional heat dissipation or fan cooling may be required to meet the desired continuous rating. During the design and development of the final product, steps must be taken to ensure that EMC performance complies with applicable regulations. The suggestion sat in Appendix B. The1234/36/38 controller contained esd-sensitive components. Use appropriate precautions for connecting, disconnecting, and handling controllers. See the installation suggestions for Appendix B to protect the controller from ESD damage. Figure 2b mounting dimensions, Curtis 1236 and 1238 motor controllers. Working in millimeter (and inch) 4 Curtis 1234/36/38 manual, OS 11 9 2 installation and wiring C A U T I O N electrical system is potentially dangerous. It is necessary to prevent uncontrolled operation, high current arcs, and gas removal from lead acid batteries: some uncontrolled operating conditions can cause the motor to become out of control. Remove the motor, jack up the vehicle, and get the drive wheel from the ground before attempting to work on the motor control circuit. High-current ARCS batteries can provide very high power and can cause arcs if shorted. Always open the battery circuit before In the motor control circuit. Wear safety glasses and use properly insulated tools to prevent shorts. LEAD ACID battery charging or discharging can be accumulated in and out of the battery by generating hydrogen gas. Follow the battery manufacturer's safety recommendations. Wear safety glasses. Curtis 1234/36/38 Manual, OS 11 5 10 2 Installation and Wiring: High Current Connection slot with five high current terminals, identified in the controller housing with B+, B-, U, V, and W. Table 1 high current connection terminal functions B+ positive battery controller. Negative battery on b-controller. U Motor Phase U. V. Motor Phase V. W Motor Phase W. Lug Assembly: 1234 Model 5 Aluminum M6 Terminals are provided. Lugs must be installed using m6 bolts of size to provide proper engagement (see diagram): Place the lug on top of the aluminum terminal and place a high-load safety washer with a convex side. The washer must be schnor or equivalent. If you use two lugs in the same terminal, stack them to ensure that the lugs carrying the least current are at the top. Tighten the assembly to 10.2 ±1.1 Nm (90±10 in-lbs). 6 Curtis 1234/36/38 Manual, OS 11 11 2 Installation and Wiring: High Current Connection Lug Assembly: 1236 and 1238 Model 5 Brass M8 Terminals are provided. Lugs must be installed using m8 bolts of size to provide proper engagement (see diagram): Place the lug on top of the brass terminal and place a high-load safety washer with a convex side. The washer must be schnor or equivalent. If you use two lugs in the same terminal, stack them to ensure that the lugs carrying the least current are at the top. Tighten the assembly to 9.6±0.9Nm (85 ±8 pounds). Note: The terminals can be rotated up to ±5 from the cover. High current wiring recommendations: All model battery cables (B+, B-) these two cables must run close to each other between the controller and the battery. Use high quality copper rugs and adhere to the recommended torque rating. For maximum noise immunity, the cable should not run across the central section of the controller. Use multiple high current controllers to use star rings on battery B terminals. Motor wiring (U, V, W) three-phase wires are close to the same length and must be bundled together when running between the controller and the motor. The cable length should be as short as possible. Use high quality copper rugs and adhere to the recommended torque rating. For maximum noise immunity, motor cables should not run across the central section of the controller. In applications seeking the lowest possible emissions, the shield can be placed around the bundled motor cable and connected to the B-terminal of the controller. Typical installations easily pass emission standards without a shield. Low current signal wires should not run next. Motor cable. If necessary, the motor cable must be crossed at right angles to minimize noise coupling. Curtis 1234/36/38 Manual, OS 11 7 12 2 Installation and Wiring: Low Current Connection Low Current Connection All low power connections are made via a single 35-pin AMPSEAL connector. The mating plug housing is AMP p/n and the contact pin allows 20-16 AWG wires with amp p/n connectors with thin wall insulation from 1.7 to 2.7 mm diameter. 35 individual pins are featured in Table 2. J1 Low Current Wiring Recommendations When running between the motor encoder (pin 31, 32) motor and the controller logic connector, all four encoder wires must be bundled together. These can often run with the rest of the low current wiring harness. Encoder cables should not be run near motor cables. In the required applications, the shielding cable must be used only on the controller side with the ground shield connected to the I/O ground (Pin 7). In extreme applications, you can use a common mode filter, such as ferrite beads. Can bus (Pins 21, 23, 34, 35) is recommended to run the CAN wire in a twisted pair. However, many successful applications of 125 kbaud will run without stumbling, and simply use two lines bundled with the rest of the low current wiring. CAN wiring should stay away from high current cables and intersect at right angles when needed. All other low current wiring remaining low current wiring should be executed in accordance with standard practices. Performing low current wiring next to high current wiring should always be avoided. 8 Curtis 1234/36/38 Manual, OS 11 13 2 Installation and Wiring: Low Current Connection Table 2 Low Current Connection Pin Name Description Related VCL* Feature Reference 1 KSI Key Switch Input. provides logic power to the controller and power for the Setup_BDI Keyswitch_Voltage coil driver. 2 Props. Driver proportional driver. Automate_PWM Sw_13 this is a coil driver with PD_Current Put_PWM PWM5 current control, which is commonly used in PD_Output proportional valves in PD_Throttle hydraulic manifolds. It can also be used as a digital input for VCL_PD_Throttle. 3 drivers 4 regular driver #4; Automate_PWM Sw_12 can also be used as a digital Put_PWM PWM4 input. Low frequency PWM4_Output with PWM capability. 4 drivers 3 general driver #3; It can also be used as a digital Put_PWM Automate_PWM Sw_11 pwM3 input. PWM features PWM3_Output low frequency. It is typically used for pump contactors. 5 drivers 2 regular driver #2; Automate_PWM Sw_10 digital Put_PWM can also be used as PWM2 inputs. It has a low frequency PWM2_Output the PWM function and a slightly higher current rating. 6 drivers 1 regular driver #1; Automate_PWM Sw_9 can also be used as a digital Put_PWM PWM1 input. Low frequency Set_Interlock PWM1_Output with PWM function. Interlock_State are commonly used in key Main_State contactors. 7 I/O ground input and output ground reference. 8 Switch 2 can be used for regular Sw_2 analog 2 switch input #2 or Analog2_Input general analog input #2. It is typically used as an analog input for motor temperature. 9 Switch 3 general switch input #3. Sw_3 is typically used as an interlock switch. 10 Switch 4 general switch input #4. Sw_4 11 switch 5 general switch input #5. Sw_5 * Related VCL columns are very important when writing VCL code (see Section 7). The VCL feature is used to access various I/Os. The VCL reference is a predefined name for a particular pin. Curtis 1234/36/38 Manual, OS 11 9 14 2 Installation and Wiring: Low Current Connection 12 Switch 6 General Switch Input #6. Sw_6 13 coil return is a coil return pin for all contactor coils. 14 Switch 16 / DNC at 1234, this is Sw_16 general switch input #16. Do not connect at 1236 and 1238. 15 throttle pots and connect high 3 wire throttle pots. Table 2 low current connection, see d-related VCL PIN name description feature 16 throttle pot for wiper port wipers Setup_Pot Throttle_Pot. Setup_Pot_Faults Throttle_Pot_Output 17 Pot2 Wiper Pot Wiper Setup_Pot Brake_Pot Brake Port. Setup_Pot_Faults Brake_Pot_Output 18 pots and a common pot connected to the low Pot_Low_Output throttle and brake pots. Yes, this remains a Brake_Pot in the VCL. 19 Digital Out 6 Open Collector Digital Set_DigOut Sw_14 Output. You can also use the DigOut6 Clear_DigOut as a digital input. Dig6_Output 20 Digital Out 7 Open Collector Digital Set_DigOut Sw_15 Output. You can also use the DigOut7 Clear_DigOut as a digital input. Dig7_Output 21 CAN term H-high connection for 21 CAN exit jumper. 22 Switch 7 general switch input #7. Sw_7 is typically used as an forward switch. 23 CANH CAN can be a high bus. 24 switch 1, such as Setup_CAN Setup_Mailbox Send_Mailbox, can be used for regular Sw_1 analog 1 switch input #1 or Analog1_Input general analog input #1. Typically, emergency station switches (if applicable) v out unregulated low-power Ext_Supply_Current +12V output V output V output V output regulatory low power 5_Volts_Output used for +5V output. Ext_Supply_Current 27 Pot2 High Pot is a high connection for 3 wire brake ports. 10 Curtis 1234/36/38 Manual, OS 11 15 2 Installation and Wiring: Low Current Connection Table 2 Low Current Connection, See Continuous d-Related VCL PIN Name Description Feature 28 Serial TX Serial Transmission Line for Display or Flash Update Setup_Serial. 29 serial RX serial reception line for Setup_Serial flash updates. 30 analog output low power, low frequency Automate_PWM PWM6 0 10V analog output. Put_PWM Analog_Output 31 Encoder A Quadruzer Motor_RPM Input Phase A. Motorspeed A 32 Encoder B Quadrature Encoder Motor_RPM Input Step B. MotorSpeed B 33 Switch 8 General Switch Input #8. Sw_8 typical With the reverse switch. 34 CAN term L low connection for can bus exit jumper. 35 CANL canbus there. Setup_CAN Setup_Mailbox Send_Mailbox Curtis 1234/36/38 Manual, OS 11 11 16 2 Installation and Wiring: Standard Wiring Diagram controller Wiring: Basic Configuration Basic Wiring Diagram shown in Figure 3. Throttles and brakes are represented by a three-wire formation system in the chart. Other types of throttle and brake inputs are easily acceptable and are discussed in the next throttle wiring section. The main contactor coil must be directly connected to the controller as shown in Figure 3 to meet EEC safety requirements. The controller can be programmed. 3 Basic wiring diagram, Curtis 1234/36/38 motor controller. 12 Curtis 1234/36/38 Manual, OS 11 17 2 Installation and Wiring: Throttle wiring welds or missing contactor defects, and uses key contactor coil driver outputto remove power from controllers and motors in the event of a variety of other defects. If the main contactor coil is not connected to pin 6 on the 35-pin connector, as shown, the system does not meet EEC safety requirements because the controller cannot open the main contactor under severe fault conditions. Basic wiring diagrams are designed for general applications and may not fully meet the requirements of the system. These controllers have a very flexible I/O and wiring configuration. You can contact your local Curtis representative to discuss a specific application. Switch input wiring parameter settings are dedicated to certain functions as shown: Switch 1: EMR enabled = on and emr type = 0 (see page 59) for emergency station input. Switch 3: Interlock type = interlock input of 0 (see page 48). Switch 5: Lift the input (depending on the VCL program). Switch 6: Low input (depending on the VCL program). Switch 7: Pass input if there is throttle type = 1 3 (see page 42). Switch 8: For throttle type = 1 3, reverse the input (see page 42). In this guide, the term throttle is used as a generic term for both drive throttle and brake throttle, as well as a different name for the drive throttle. The wiring is the same as whether the throttle in question is used for braking or acceleration. Various throttles can be used with 1234/36/38 controllers. They are characterized by one of five types from the 1311 programmer's programming menu. Type 1: Type 2: Type 3: Type 5: 2-Wire 5KΩ 0 Potentiometer Single End 0 5V Throttle, Current Source Throttle, 3 Wire All-Electric Iometer, Electronic Throttle 2 Wire 0 5Ωk Typical Wijeongmetric Wigwag 0 5V Throttle and 3 Wire Potentiometer VCLmeter VCL Input (VCL_Throttle or VCL_Brake) are equipped with a two-VCL_Brake throttle (or VCL_Throttle VCL_Brake VCL_Brake). Curtis 1234/36/38 Manual, OS 11 13 18 2 Installation and Wiring: Throttle For full power, the controller provides complete throttle defect protection to meet all applicable EEC regulations. For voltage throttles, the controller protects against out-of-range wiper values, but does not detect wiring errors. Therefore, it is the OEM's responsibility to use voltage throttle to provide full throttle fault protection to the vehicle. Throttle type 1 3 uses forward and reverse inputs (switches 7 and 8) in addition to the throttle pot input that defines the throttle command (see Figure 15, Page 92). Throttle types 4 and 5 do not use front and reverse inputs. The wiring for the most common throttles is described in the following text and is shown in the accompanying picture. If the throttle you are trying to use does not apply, contact the nearest Curtis office. Picture. 4 wiring for type 1 throttle. In the case of these two wire resistance potential ometer shown in Figure 4 throttle type 1, the entire throttle request corresponds to the 0 Ω measured between the pot wiper pin and the port low pin. Broken wire protection is provided by a controller that detects current flow from the pot wiper input (pin 16 or 17) through potential error and detects the current flow to the pot low (pin 18). If the pot low input current falls below 0.65ma, a throttle error occurs and the throttle request is zero. Note: Pot lows (pin 18) should not be tied to ground (B-). With throttle type 2, the controller finds a voltage signal in the wiper input. Zero throttle requests correspond to 0 V and 5V for full throttle requests. A variety of devices, including voltage sources, current sources, three-wire pots, and electronic throttles, can be used with this throttle input type. As shown in Figure 5, each wiring is slightly different and has a different level of throttle defect protection. If the voltage source is used as a throttle, it is the OEM's responsibility to provide adequate throttle fault detection. For ground reference 0 5V throttle, the controller detects open brakes in the wiper input, but cannot provide full throttle fault protection. To use the current source as a throttle, the resistor must be added to the circuit to convert the current source value to voltage. The resistor must be large to provide 0 5V signal change over the entire current range. It is oem's responsibility to provide appropriate throttle error detection. 14 Curtis 1234/36/38 Manual, OS 11 19 2 Installation and Wiring: Throttle Wiring And Wiring for Type 5 Type 2 Throttle. Voltage source current source 3 wire Potentiometer Curtis ET-XXX electronic throttle Curtis 1234/36/38 manual, OS 11 15 20 2 installation and wiring: throttle wiring mudodo. Wiring for 6 type 3 throttles. When using a three-wire potential, the controller provides complete defect protection according to EEC requirements. The pot is used in voltage cubicle mode with the controller. Voltage source and return. The pot provides a limited 5V sauce currently in a high pot, and the pot row provides a return path. This is the throttle shown in the basic wiring diagram (Figure 3) for the drive throttle and brake throttle. ET-XXX electronic throttles are typically used only as drive throttles. ET-XXX does not detect built-in errors, and the controller only detects open wiper errors. It is the OEM's responsibility to provide the necessary additional throttle error detection. In the case of the two-wire resistance full width shown in Figure 6 throttle type 3, the entire throttle request corresponds to the 5kω measured between the pot wiper pin and the port low pin. Broken wire protection is provided by the controller, which detects the current flow from the wiper input (pin 16 or 17) to the pot low (pin 18) through the potential error. If the pot low input current falls below 0.65ma, a throttle error occurs and the throttle request is zero. Note: Pot lows (pin 18) should not be tied to ground (B-). Throttle Type 4 Type 4 Throttle works in a Wigweg style. A signal to the controller is forwarded and no inverse input is required. The direction is determined by the wiper input value. Only 0 5V voltage source and 3 wire potential type 4 throttle can be used. The controller interface of the Type 4 throttle is the same as the Type 2 throttle. See Figure 5. The neutral point will be accompanied by the wiper at 2.5 V, measured between the pot wiper input (pin 16) and the I/O ground return (Pin 7). As the wiper input value increases, the controller increases the forward speed and the inverse speed increases as the wiper input value decreases. With a three-wire pot, the controller provides full fault protection. The voltage throttle allows the controller to detect open brakes in the wiper input, but cannot provide full throttle fault protection. 16 Curtis 1234/36/38 Manual, OS 11 21 2 Installation and Wiring: Throttle Wiring Throttle Type 5 Throttle Type 5 provides another way to send throttle commands to the controller. This type of throttle uses the VCL to define the throttle signal to be entered into the throttle signal chain (see Figure 15, Page 92). This throttle type can be used for drive throttle or brake throttle using the VCL variable VCL_Throttle and VCL_Brake. The way you write a VCL program is a very flexible throttle input method by determining the location of the throttle signal. The VCL can be written to use throttle pot inputs, input transitions, or CAN communication messages as a source of throttle signals. If you have questions about this throttle type, please contact the nearest Curtis office. Setting the throttle type to 5-inch allows the VCL program to override throttle and brake port inputs for purposes other than throttle or brake input. Tthe The names that the VCL can use to interface with these two inputs are Throttle_Pot_Output (see page 93) and Brake_Pot_Output (see page 95). Curtis 1234/36/38 Manual, OS 11 17 22 Installation and Wiring: I/O Signal Specification Input/Output Signal Specification 35-pin Connector Wired Input/Output Signals can be grouped by type as follows: Their electrical characteristics are described below. The digital output low power output is a high-power analog output analog output analog output, which outputs ksi and coil return input throttle and brake input communication port input/output encoder input. These control lines of digital input can be used as digital (on/off) inputs. When connecting, the top is directly connected to B+. Go directly to B-off. If no connection is made, the input is pulled low (off). All digital inputs are protected from shorts to B+ or B-. Nine of these lines (Switchs 1 8, 16) are designed to keep switch tangents clean and pull currents to prevent leakage paths from causing incorrect signals. The remaining line is a digital input related to the driver output. Note that they have a much higher input impedance. Both digital output lines are also included in this group because they can be read as inputs. Lines of pin 24 and 8 can also be used as analog inputs and are included in that group. Digital input specification 1234 (DNC 1236/38) 1236/ Signal name pin logic threshold input impedance voltage range* ESD tolerance switch 1 24 rising edge= 24-36V model: -10 V to ± 8 kv (air Switch V up to about 7.1 kω (MaxV + 10 V) discharge) Switch 3 9 falling edge = 36-48V model: switch V minutes about 11.0 kω switch V model: switch 6 12 about 26.0 ω switch 7 22 switch 8 33 Switch Digital Out 6 19 Rising Edge= Down 5.5 V= 5 V V Up to 134K (MaxV + 10 V) Falling Edge= Above 5.5 V= 10.1 V Min 124 kω Digital Out 6 19 Rise Edge= Down 1 0 V = V = V - Digital Out V Up to 300 kω (MaxV + 10 V) Driver 1 6 Falling Edge = 10 V = Driver V Min 150 Kω Driver 3 4 Driver 4 3 Prop Driver 2 * MaxV Controller Maximum Voltage : 30 V for 24V model; 24 36V model for 45 V; 36 48V model for 60V; 105 V. 18 Curtis 1234/36/38 Manual for 48 80V models, OS 11 23 2 Installation and Wiring: Two control lines with I/O signal specification low power output 1236/38 are available as low-power digital outputs. These are open collector drivers that can sink only current, not source, and are intended to drive LEDs or other low current loads connected to + 5V or +12V external power supplies. See power supply output group specifications. If the output is turned on, if the output voltage exceeds about 15 V, error prevention releases these outputs (low output). Both outputs are protected from shorts to B+ or B-. These lines can also be used as digital inputs and are included in those groups. Low Specification permissible output protection ESD signal name PIN voltage IMPEDANCE voltage allowed 1236/38 * Digital out 15 V on: 1 kω from B-5 V to ± 8 kv (air digital out 7 20 off: 134 kω (MaxV + 10 V) discharge) * 1234 digital output, with high output, below. High power outputs can be used as high-power output drivers with seven control lines of 1234 and five control lines of 1236/38. Of these, the proportional driver may be operated in a current control mode for driving a proportional valve or similar load. Each output can set the average output voltage independently by adjusting the continuous (low level) or pulse width. These outputs are intended to drive inductive loads such as contactors and electromagnetic brakes, but can also be used to drive resistance loads if peak current ratings are not exceeded. All these outputs are protected from shorts to B+ or B-. These lines can also be used as digital inputs and are included in those groups. High output output specification 1234 * Signal name PIN PWM PV FREQ- Current UeNCY output current current supply voltage ESD tolerance driver 100% n/a 200 Hz 2 A max V ± 8 kv (air driver 2 5 duty cycle 3 maximum key switch discharge) Driver A max Voltage driver 4 3 prop driver 2 0~2 A 18 khz 607 nominal stage digital out 6 19 on/off n/a 1 a maximum digital out 7 20 * 1234, the combined current provided by all 7 output drivers should not exceed 10 A. Curtis 1234/36/38 Manual, OS 11 19 24 2 Installation and Wiring: I/O signal specifications two control lines of analog inputs are available as analog inputs. Both inputs are protected from shorts to B+ or B-. Analog 2 is typically used as an input to the motor temperature sensor. This input provides a constant current suitable for the neuger sensor. Some standard predefined motor temperature sensors are supported by software (see sensor type parameter, page 50). Note: The industry standard KTY temperature sensor is a silicon temperature sensor with a polar band. The polar band of the KTY sensor must be single-edged to the I/O ground (Pin 7). These lines can also be used as digital inputs and are included in those groups. Analog input specification signal name pin operating voltage input impedding protection voltage ESD tolerance analog 24-36V model 10 V: 10 V ± 8 kv (air analog stage approx. 7.1 kω (MaxV + 10 V) Discharge) 36-48V model: about 11.0 kω 48-80V model: about 26.0 kω analog output one line can be used as a low-power analog output and is intended to drive measurements like battery discharge indicators. This output is generated from a filtered PWM signal and has approximately 1% ripple. The 2% settling time is for 0 5V phases <25ms and 0 for 10V phases <30 ms. This output line is protected from shorts to B+ or B-. Analog output specification signal PIN output output IMPEDANCE protection voltage ESD tolerance analog output 30 0 to 10 V source: 100 Ω - 1 V to ± 8 kv (air sink: 66 kω (MaxV + 10 V) discharge) Power supply output 2 times provides secondary output power to low power circuits such as electronic throttle, LED indicator, display, location encoder and remote/O. The I/O ground (pin 7) is the return line for these low-power devices. Both power supply outputs are protected from shorts to B+ or B-. Power supply specification signal signal pin output voltage output current protection voltage ESD tolerance +12V out 14.5 V 200 ma max - 1 V to ± 8 kv (air +5V out 26 5 V ±5% (total total) (MaxV + 10 V) discharge) I/O ground 7 n/a 500 ma Maximum Unprotected 20 Curtis 123/36 OS 11 25 2 Installation and Wiring: I/O Signal SpecificationS KSI and Coil Return KSI Inputs provide power for all low-power control circuits, power capacitor sped-up (before the main contactor is on), power supply output and high power output for drivers. The battery voltage is detected in the input to the VCL battery discharge function. The coil return must be connected to the positive battery side of the contactor, which is driven so that the switching noise associated with the PWM operation of the contactor is limited to the contactor wiring. It is important to maintain the split between the KSI and the coil return to ensure reverse polar protection (vehicle wiring modification, battery terminal reversal). KSI and coil return input specification signal name PIN operating current voltage ESD tolerance KSI 1 under-1.0 maximum * ± (MaxV + 10 V) ± 8 kv (air and overvoltage discharge) coil return 13 cutback 12 A up ** (KSI-0.3 V) ~ (MaxV +10 V) * Also supplied by the driver to coil return (pin 13). ** The combined current supplied by seven output drivers at 1234 should not exceed 10 A. throttle and brake inputs, and the two pot inputs can be programmed independently to use voltage throttle or two wire or 3 wire resistance throttles. The voltage throttle only requires a port wiper input (I/O ground ing of the return line). The resistance throttle requires pot wipers and pot low (2 wires) or pot high, pot wipers, pot low (3 wires). All throttle I/O is protected from shorts to B+ or B-. Alternatively, these two inputs can be used for analog signals other than throttle and brake port inputs. VCL programming is required to configure input for use with other signals. See Section 7. Throttle input specification signal name pin operating voltage input IMPEDANCE S/SINK current current protection voltage ESD tolerance throttle pot high 15 0 V (short n/a 7 ma-50 V ± 8 kv (Potair high 27 to Pot Low) civic (MaxV + 10 V) discharge 5 V (open (source) circuit) throttle pot wiper 16 0.20 00.000 0.00000 00000 Wiper 17 (voltage nominal and 3 lines) (source, 2 wire) pot low 18 0 subject days 10 V 20 Ω no. -1 V up (MaxV + 10 V) 11 ma (sink) Curtis 1234/36/38 Manual, OS 11 21 26 2 installation and wiring: I/O signal specification communication port separate CAN and serial port provides complete communication and programming capabilities for all available controller information. Curtis 1311 handheld programmers connect to wired connectors on 28 and 29 pins with ground (pin 7) and +12V power supplies (pin 25). See wiring diagram, Figure 3. The Curtis Model 840 display can be connected to the same four-pin connector. When you wire the CAN Term H and CAN Term L pins together, the local CAN shutdown is 120 Ω 0.5 W. Keep these wires short. The CAN term H and CAN term L should not be connected to the external wiring. Communication port specification signal name pin support protocol / device data speed protection voltage ESD allow able can 23 CANopen, up to 500 kbps continuous = ± 8 kv (air CANL 35 node 2.0, - 36 V discharge) other 11-bit (MaxV + 10 V) identifier field transient = can protocol ± 200 V CAN period H 21 (± 8 kv (air can term L34 external wiring) emissions TX 28 -0.3 ~12V ± 8kv (air serial RX handheld 9.6 ~56kbps discharge) programmer, The two control lines of the 1314 PC programming station encoder input are configured to read the quadrant position encoder internally. Encoders typically supply power from 5V supply (pin 26) or 12V supply (pin 25), but can be powered from external supplies (5V to B+) as long as logical threshold requirements are met. ENCODER input specification MAX protection ESD signal name PIN threshold IMPEDANCE FREQ. Voltage tolerance encoder A 31 rising edge = 720 Ω 10 khz - 5 V ± 8 kv (air encoder B V Max (inside (Max V +10 V) discharge) falling edge = pull up 2.2 V mins ~ +4V 34 36 OS 11 27 3 Programmable Parameters 3 Programmable Parameters These controllers have multiple parameters that can be programmed using curtis 1311 handheld programmers or 1314 programming stations. For programmer work, appendix C. See the programming menu See Programable parameters are grouped into nested layer menus as shown in Table 3. : Choose speed mode express speed mode torque mode. Speed Mode Express is a simplified version of speed mode with a reduced set of parameters suitable for most speed control applications. Speed of use Alternatively, speed mode express for applications where throttle input corresponds to motor speed output. Use torque mode for applications where throttle inputs correspond to motor torque outputs. Note: You can use torque controls or speed controls to adjust, but you can't adjust both. For example, if you adjust the torque control parameters while speed mode or speed mode express is selected for tuning mode, the programmer will display the new settings but have no effect. C A U T I O O N We strongly urge you to read section 5, initial settings before adjusting some of the parameters. Even if you leave most of the parameters in your preferences, you should follow the proceduredescribed in Section 5, which sets the default system characteristics of your application. Curtis 1234/36/38 Manual, OS 11 23 28 3 Programmable Parameter Table 3 Programmable Parameter Menu: 1311 Programmer Control Mode... p Speed Mode Express... p. 28 Max Speed Kp Ki Accel Speed Deci Speed Deci Speed Brake Speed Pump Activation 1 - Speed Mode Menu Speed Controller... p. 29 maximum speed Kp Key Bell feed forward... p. 29 Kvff Build Speed Release Rate Acc Feed Forward... p. 30 Kaff Kbff Build Speed... p. 31 Full acceleration rate HS Full Acceleration Speed LS Low Speed [HS Neutral Decelate LS Full Brake Speed HS Full Brake Speed LS Low Brake Speed Fine adjustment] p. 32 Partial Deci speed HS (High Speed) LS (Low Speed) Reversal Smooths Maximum Speed Acceleration Dekel pump activation... p torque mode menu speed limiter ... p. 34 Max Speed Kp Ki Kd Response... p. 35 acceleration speed Accel release speed brake brake release... p. 36 creep torque brake softens the maximum speed deci redemption menu with full creep cancellation creep build speed creep release speed creep release speed gear brake taper speed reversal... p. 38 restraint forward restraints back soft stop speed position hold ... p. 38 position hold activation Kp Deadband (Motor Deg) Kd set time set time... p. 39 drive current limit Regency current limit current limit current limit Current limit EMR current... p. 40 PL nominal speed delta speed drive limit map... p. 40 Nominal Plus Delta Plus 2xDelta Plus 4x Delta Plus 8x Delta Regency Limited Map... p. 44 Nominal Plus Delta Plus 2xDelta Plus 4x Delta Plus 8x Delta Throttle Menu... p. 42 스로틀 타입 포워드 데드밴드 포워드 맵 앞으로 최대 오프셋 역방향 데드밴드 역방향 맵 역오프역 HPD/SRO 타입 시퀀싱 지연 VCL 스로틀 활성화 브레이크 메뉴... p. 45 브레이크 페달 을 활성화 브레이크 유형 브레이크 데드 밴드 브레이크 맵 브레이크 최대 브레이크 오프셋 VCL 브레이크 활성화 24 커티스 1234/36/38 매뉴얼, OS 11 29 3 프로그래밍 가능한 매개 변수 테이블 3 프로그래밍 가능한 매개 변수 메뉴: 1311 프로그래머, cont d EM 브레이크 컨트롤 메뉴... p. 46 brake type Voltage holding voltage battery voltage composition setting EM brake failure setting speed threshold emission setting speed set time charge delay... p. 48 main induction pull-in voltage retention voltage battery voltage composition interlock type open delay check enabling major DNC threshold pre-charge enabling proportional driver... p. 50 PD enableable hydration low enable PD maximum current PD min current PD diter % PD diter period PD PD PD gi hydraulic contactr ... p. 51 contactor enables pull from voltage maintenance voltage failure inspection... p. 52 driver1 scan enable driver2 inspection, enable driver3 inspection, enable driver4 inspection, enable PD inspection, external supply maximum external supply minimum motor menu... p. 53 typical maximum speed swap encoder direction swap two-stage encoder step temperature control... p. 54 sensor activation sensor type sensor offset temperature hot temperature... p. 55 nominal voltage low voltage cutback range user overvoltage user overvoltage reset per cell per cell full volt per volt cell emission time BDI reset per cent dual drive menu... Dual drive appendix, p/n DD. Vehicle menu of Sec. See 4... p. 58 meter unit speed RPM capture speed 1 capture speed 2 capture distance 2 capture distance 3 emergency reverse menu... p. 59 EMR activation EMR type EMR Dir interlock EMR time limit EMR speed EMR acceleration speed EMR... p. 60 Decrate HS Decirate LS Interlock Break Out... p. 61 CANopen Interlock CAN NODE ID Dock Speed Heartbeat Speed PDO Time Out Period Emergency Message Speed Suppression CANopen Init Motor Control Tuning Menu Motor Characterization Test. p. 62 field weakening control ... p. 62 FW base speed field... p. 62 Curtis 1234/36/38 manual, OS 11 25 30 3 PROGRAMMABLE parameters individual parameters are displayed in the menu chart as follows: the parameter name tolerance description of the parameter appears in the function, and if applicable, the programmer display programmer's unit proposal defines the maximum motor for setting the maximum speed rpm. Note Max_Speed_SpdM parameter name tolerance in The VCL in the VCL unit: Every bit variable has two VCL parameter names. The first is the name of the bit, and the second is the name of the byte containing the bit. The bit position within the byte is represented by the byte name and then parentheses. Example: Bit name: Metric_Units Byte name: optionBits3 [bit 5] Bit name: EMR_Dir_Interlock BYTE name: EMR_Dir_Interlock_Bit0 [bit 0] in the second example is part of the _Bit0 byte name and does not represent a bit location. This byte, like all bytes, has eight available bits. Each bit variable pair within a menu chart The next byte name appears first: Metric unit Metric_Units OptionBits3 [bit 5] on/off 26 Curtis 1234/36/38 Manual, OS 11 31 3 Programmable parameters: Control mode selection parameter mode selection limit description Control mode selection 0 2 This parameter is 0 2 programming motor response Control_Mode_Select if any control method is determined to work: 0 = speed express mode = 1 speed mode = 2 . If you are interested in custom control methods, please contact Curtis. Note: Do not change this parameter while the controller is powering the motor. Whenever this parameter changes, the parameter change error (error code 49) is set and must be cleared by cycling power. This protects the controller and operator. Note: Motor speed constraints Maximum motor speed is a programmable parameter in each control mode. Regardless of which control mode is used, the maximum motor speed the controller allows is limited by the number of motor poles, the number of encoder pulses per motor revolution, and the maximum speed constraints imposed by the firmware. Electrical frequency constraint controller output maximum electrical frequency is 300 Hz, which uses equation Max Motor RPM = / number of motor poles (e.g. a 6-pole motor can operate up to 6000 rpm) to determine the speed at which the motor can rotate. The maximum encoder frequency allowed by the encoder pulse/revolution constraint controller is 10 khz. To determine how fast this constraint can rotate a motor, use equation Max Motor RPM = /encoder size (for example, a motor with a 128-pulse encoder can run up to 4687 rpm). The maximum motor speed allowed by the firmware maximum speed constraint controller is 8000 rpm. The maximum maximum motor speed allowed is the smallest of these three constraints. Curtis 1234/36/38 Manual, OS 11 27 32 3 Programmable Parameters: Speed Controller Parameters (SPEED MODE EXPRESS) 0 Speed Mode Express Speed Mode Express Menu Allowed Parameter Range Description Maximum Request Motor Rpm Defined in Full Throttle. The throttle with partially Max_Speed_SpdMx scales proportionally. For example, a 40% applied throttle corresponds to a request for 40% of the set maximum speed value. Note: The maximum motor rpm is subject to a 27-page constraint. Kp% determines how aggressively the speed controller tries to match the speed of the motor Kp_SpdMx the commanded speed. Higher values allow for tighter controls. If the gain is set too high, vibrations may occur when the controller tries to control the speed. If set too low, the motor will operate slowly, making it difficult to control. The Ki% integration term (Ki) ensures no healthy state errors, so the motor Ki_SpdMx runs at exactly the commanded speed. The higher the value, the Control. If the gain is set too high, vibrations may occur when the controller tries to control the speed. If it is set too low, the motor may take a long time to access the correct command speed. Accel Speed Seconds. Set the speed command Accel_Rate_SpdMx increase in seconds when the throttle is applied. The higher the value, the slower the response. Dessel Speed Seconds Decel_Rate_SpdMx. The higher the value, the slower the response. Brake speed seconds Brake_Rate_SpdMx. The higher the value, the slower the response. Pump enable on/off This parameter should be programmed to work on/off the pump motor AC_Pump_Enable_SpdM, not the vehicle-driven motor. Speed controller responsiveness and AC_Pump_Enable_SpdM_Bit0 [Bit 0] stability are improved, and the motor can only rotate in the forward direction. 28 Curtis 1234/36/38 Manual, OS 11 33 3 Programmable parameters: Speed controller and speed feed-forward parameter (SPEED MODE) 1 Speed MODE menu allowed parameter range description Maximum speed rpm to define the maximum request motor rpm in the entire throttle. The partially applied Max_Speed_SpdM throttle is scaled proportionally. For example, a 40% applied throttle corresponds to a request for 40% of the set maximum speed value. If Max_Speed_SpdM <100rpm (via VCL or CAN), the throttle request is set to zero. Note: The maximum motor rpm is subject to a 27-page constraint. Kp% determines how aggressively the speed controller matches the speed of the motor Kp_SpdM the commanded speed. Higher values allow for tighter controls. If the gain is set too high, vibrations may occur when the controller tries to control the speed. If set too low, the motor will operate slowly, making it difficult to control. The Ki % all-in-one term (Ki) runs Ki_SpdM at exactly the commanded speed of the motor to ensure no normal state errors. Higher values allow for tighter controls. If the gain is set too high, vibrations may occur when the controller tries to control the speed. If it is set too low, the motor may take a long time to access the correct command speed. 1 Speed Feed Forward Menu [Optional] Allowparameter Range Description Kvff A Speed Supply Delivery Period is designed to improve throttle responsiveness Kvff_SpdM speed controller performance, especially at low speeds. For traction systems, set to 50 to 70% of the current required to maintain a very low speed and unload on a flat surface. For pump

systems, set to the lowest load current, such as current running at the minimum load. Alternatively, the responsiveness of the pump speed control loop can be greatly improved. Use the VCL program to continuously update this parameter to the appropriate value when each pump load is requested. The build rate seconds determine how quickly the Kvff term is built. For Vel_FF_Build_Rate_SpdM traction systems, if you suddenly hear a mechanical slope pickup when moving the throttle from neutral to a very small value, slowing the build rate (i.e. set to a higher value) softens the feeling. For pump systems, start with this parameter at the minimum setting. Slowing down (that is, set to a higher value) slows down the overshoot rate if too many feedforwards are commanded. Release speed to determine the speed of the kvff term release in seconds. If the release appears to be too abrupt, the Vel_FF_Release_Rate_SpdM that slows down the release (for example, set to a higher value) softens the feeling. You should set it fast enough to prevent the vehicle from continuing after the throttle release (i.e., low enough value). Curtis 1234/36/38 Manual, OS 11 29 29