Manual of HNC-21/22
Century Star Series NC System
June 28 2006

Brief Introduction

Wuhan Huazhong Numerical Control Co., Ltd (HCNC) is a high-tech enterprise dedicated to CNC research, development and production. It has a staff of 280. Our technology is supported by the National Research Center of CNC Technology at Huazhong University of Science & Technology (HUST). Our annual production capacity is five thousand sets of CNC controllers.

Our leading product Century Star series CNC controller, is well-known for its open architecture and cost-performance. It has has been widely applied in both industry and education in China. We also produce servo drives and motors to offer a complete industry solution for our users worldwide. A National Standard quality test center ensures the quality of our products. We were awarded the ISO9001:2000 in 2000. Every controller is extensively tested before they are shipped to our users.

We are also actively engaged in global competition. We have conducted two International Workshops on CNC technology for Developing Countries. Our international market includes Thailand, Vietnam, Pakistan, Malaysia and Argentina.
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Sample for Turning System
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1 Century Star HNC-21/22 CNC System

Introduction

_Century Star series CNC system_ with built-in PLC adopts advanced open architecture, embedded IPC, 8.4’/10.4’ color LCD screen and universal engineering panel. The interfaces for feeding axes, spindle, handheld unit are integrated into the controller. The system is compatible with hard disk, electronic disk, and floppy drive; DNC and Ethernet support program exchange. The HNC-21/22 system is well-known for its low-cost, high-performance, flexible configuration, compact structure, easy operation and high reliability. They are widely used for lathes, milling machines and machining centers.

**HNC-21/22T Turning system**
- Max coordinate axes: 3
- Compatible with various pulse or servo driving systems (e.g.: HSV-16 serial full-digital AC Servo driving unit)
- Standard machine control panel. 40/32 bit switching values, I/O interfaces, handheld unit interface, spindle control and encoder interface.
- 8.4’(HNC-22T:10.4’)color LCD (resolution: 640×480), multi-language interface. Diagnostics and alarm, graphic display and simulation of machining trace, easy to operate and use.
  - ISO G code programming, compatible with popular CAD/CAM. Linear interpolation, arc interpolation, threading, tool compensation, macro-program. Backlash, pitch compensation.
  - Easily communicate with machine through built-in RS232 interface.
  - 32MB Flash RAM(2GB expandable) power-off storage, 32MB RAM machining buffer.

**HNC-21/22M Milling system**
- Max coordinate axis: 6
- Compatible with various of pulse or servo driving systems (e.g: HSV-16 serials full-digital AC Servo driving unit)
- Standard machine control panel. 40/32 bit switching values I/O interfaces, handheld unit interface, spindle control and encoder interface.
- 8.4’(HNC-22T:10.4’)color LCD (resolution: 640×480), multi-language interface. Diagnostics and alarm, graphic display and simulation of machining trace, easy to operate and use.
- ISO G code programming, compatible with popular CAD/CAM programs: linear interpolation, arc interpolation, threading, tool compensation, macro-program, canned cycle, rotate, scale.
- Continuous small segment machining for CAD/CAM designed moulding.
- Machining breakpoint save/resume for users’ convenience.
- Backlash, pitch compensation
- DNC independent machining program storage up to 2 GB for G codes programs.
- Communicate easily with machine through built-in RS232 interface.
- 32MB Flash RAM(2GB expandable) power-off storage, 32MB RAM machining buffer.

**System Option**
1. Floppy disk
   - Fully sealed
● 3.5’ standard floppy drive
● Standard PC keyboard adaptor
● RS232, Ethernet adaptor
2 Ethernet
● 10M/100M self-adapted
● NT/Novell supported
● File transportation supported
3 Handheld unit
● Pulse generator
● Coordinate select
● Ratio select
● E-stop
● Enable button
4 I/O terminal board
5 Relay output terminal board

HNC-21/22 CNC System Introduction

System configuration

- Program buffer: basic 32MB, extended to 16MB., Protection memory of part program and breakpoint: basic 32MB, 2 GB extendible
- Interface type of feed axis: pulse interface
- Spindle driving unit interface
- Spindle encoder interface
- Switch I/O interface: 40 /32
- Handheld unit interface
- Floppy interface
- RS232 interface
- Ethernet interface (optional)
- Standard PC keyboard interface
- Handheld unit
- Floppy unit
- I/O terminal board (NPN & PNP switch value supported)

CNC Function

- Maxi axis controllable: 6 feed axes +1 spindle
- Max. axis coordinate :6 / 3 (M/T)
- Minimum Resolution : 1 um
- Maximum move speed: 16m/min (depends on driving unit and machine)
- Function of linear/circle/threading
- Auto control of acceleration/deceleration(line/parabola)
- Return to reference point
- Set coordinate
- Function of MDI
- Functions of M, S and T
- Graphics static simulation and real-time tracing while machining
- Internal electronic gear
- Simple canned turning
- Multiple canned turning

**CNC Programming**
- Minimum Programming unit: 0.001mm
- Maximum Programming size: 99999,999
- Maximum Programming blocks: 2,000,000,000
- Programming with metric/imperial
- Absolute/incremental programming
- Diameter/radius programming
- Macro instruction programming
- Subroutine call
- Auto-control chamfering
- Set work piece coordinate
- Coordinate rotate, scale

**Editing**
- Background edit
- Search and replace
- Delete and copy

**Display**
- Chinese/English menu
- Graphical display
- Status display
- Current position display
- Program display
- Program error display
- Operator error display
- Alarm display
- Coordinate setting display
- Spindle speed and override
- Feed speed and override
- Rapid feed and override
- Self-diagnostics
**Interpolation**

**HNC-21/22T**
- Linear interpolation: 3 axes maximum
- Circular interpolation
- Helical interpolation

**HNC-21/22M**
- Linear interpolation: 6 axes maximum
- Circular interpolation
- Helical interpolation
- Screw cutting

**Tool compensation**
- Tool length compensation
- Tool radius compensation

**Reference Point**
- Setting reference point position
- Setting reference point switch deflection
- Setting returning to reference point rapid speed
- Setting returning to reference point position speed

**Data Exchange**
- RS232
- Ethernet (optional)
- 3.5" floppy disk (optional)
- CF card

**Operation**
- 8.4’/10.4’ color LCD
- Static-free program panel and machine operation panel
- Standard PC keyboard interface
- Handhold unit (optional)
- Graphics display and dynamic real-time simulation
- Function of network communication (optional)

**Programming modes**
- Automatic
- Single block
- MDI mode
- JOG
- Step incremental feed
- Handhold incremental feed
- Manual/auto return to reference point
- Feed holding
- Re-adjust tool
- Dry run
- Return to breakpoint

**Coordinate monitoring**
- Displaying machine coordinate
- Displaying work-piece coordinate system
- Displaying tracing error
- Displaying feed remain
- Displaying Feeding rate
- Displaying spindle speed
- Displaying instruction position
- Displaying actual position
- Origin display of work piece coordinate
- Displaying moving track

**Feed axes function**
- Functions of unrestrained rotary axis
- Maximum setting speed: 16,000 mm/min
- Feed override: 0% to 150%
- Rapid move override: 0% to 150%
- Feed per minute / feed per revolution.
- Various home modes: single/bi-direction
- Setting rapid move and accelerate/ decelerate feed
- Setting Max. tracing error

**Auxillary Function**
- Spindle CW/CCW
- Automatic tool change
- Cooling on/off

**Spindle Function**
- Spindle speed: controlled by PLC programming (Maximum 99999 rpm)
- Spindle override: 0% to 150%
- Displaying spindle speed and override
- Ratio and Ratio grade: controlled by PLC programming
- Encoder interface
Threading
- Spindle position

**PLC Function**
- Build-in PLC
- Standard PLC samples
- Displaying PLC status

**Security Function**
- Software limit position protection of Coordinate axes
- Power-off protection
- Save/resume of machining breakpoint
- Backup/resume of parameter
- Parameter authority protection
- Failure log

**Technical Specifiction**
- Input power: AC24V 50W + DC24V≥50W or DC24V≥100W
- AC power frequency: 50HZ
- Installation mode: In the control cabinet
- Operation and storage environment (shown in the table below)
- 40 bit photo electricity isolated switch value input interface
- 32 bit photo electricity isolated switch value output interface output current: 0~100mA output voltage: DC24V
- Spindle simulation output interface Resolution: 12 bit output voltage: DC±10V or 0~+10V
- Input interface spindle encoder
- Differential input of square-wave
- Input interface of handhold pulse generator: TTL level input
- Pulse output interface of feed axes/HSV-16/HSV-20 servo interface (4 pieces), pulse and direction signal with differential output, maximum pulse frequency: 2MHZ
- 4 simulaiton D/A output interface of feed axes a) current: -20mA~+20mA b) voltage: -10V~+10V
- Feedback input interface of feed encoder (4 pieces): RS422 differential input
- HSV-11 servo interface (4 pieces)
- RS232 interface

**Operation & Storage**

<table>
<thead>
<tr>
<th></th>
<th>Temperature (°C)</th>
<th>Relative Humidity</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>0-55</td>
<td>&lt;75%</td>
<td>Indoor</td>
</tr>
<tr>
<td>Storage</td>
<td>-20-60</td>
<td>&lt;90%</td>
<td>dust, water, moist free</td>
</tr>
</tbody>
</table>
Connection Schematic Diagram of HNC-21/22 CNC System

HNC-21/22 Peripheral Interface Diagram

- Power
- Keyboard
- Ethernet
- Floppy
- RS232
- Handheld unit
- XS1 XS30-XS35 Servo drive
- XS2
- XS3 XS20-XS22 Switch O/P
- XS4
- XS5 XS10-XS12 Switch I/p
- XS8 XS9 Spd unit

HNC-21/22 interfaces’ distribution
### Power Interface: XS1

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>AC 24V/1/2</td>
<td>AC 24V</td>
</tr>
<tr>
<td>2</td>
<td>DC 24V</td>
<td>DC 24V</td>
</tr>
<tr>
<td>3</td>
<td>Empty</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DC 24V GND</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td>PE</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>Empty</td>
<td></td>
</tr>
</tbody>
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### PC Keyboard Interface: XS2

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DATA</td>
<td>Data</td>
</tr>
<tr>
<td>2</td>
<td>Empty</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Power GND</td>
</tr>
<tr>
<td>4</td>
<td>VCC</td>
<td>Power</td>
</tr>
<tr>
<td>5</td>
<td>CLOCK</td>
<td>Clock</td>
</tr>
<tr>
<td>6</td>
<td>Empty</td>
<td></td>
</tr>
</tbody>
</table>

### Ethernet Interface: XS3

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX_D+</td>
<td>Data send</td>
</tr>
<tr>
<td>2</td>
<td>TX_D1-</td>
<td>Data send</td>
</tr>
<tr>
<td>3</td>
<td>RX_D2+</td>
<td>Receive data</td>
</tr>
<tr>
<td>4</td>
<td>BI-D3+</td>
<td>Empty</td>
</tr>
<tr>
<td>5</td>
<td>BI-D3-</td>
<td>Empty</td>
</tr>
<tr>
<td>6</td>
<td>RX_D2-</td>
<td>Receive data</td>
</tr>
<tr>
<td>7</td>
<td>BI-D4+</td>
<td>Empty</td>
</tr>
<tr>
<td>8</td>
<td>BI-D4-</td>
<td>Empty</td>
</tr>
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</table>

### Floppy Interface: XS4

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L1</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>L2</td>
<td>Select drive A</td>
</tr>
<tr>
<td>3</td>
<td>L3</td>
<td>Write data</td>
</tr>
<tr>
<td>4</td>
<td>L4</td>
<td>Write protection</td>
</tr>
<tr>
<td>5</td>
<td>+5V</td>
<td>Drive power</td>
</tr>
<tr>
<td>6</td>
<td>L5</td>
<td>Drive A enable</td>
</tr>
<tr>
<td>7</td>
<td>L6</td>
<td>Step</td>
</tr>
<tr>
<td>8</td>
<td>L7</td>
<td>0 track</td>
</tr>
<tr>
<td>9</td>
<td>L8</td>
<td>Disk surface selection</td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>Drive power GND, signal GND</td>
</tr>
<tr>
<td>11</td>
<td>L9</td>
<td>Index</td>
</tr>
<tr>
<td>12</td>
<td>L10</td>
<td>Direction</td>
</tr>
<tr>
<td>13</td>
<td>L11</td>
<td>Write enable</td>
</tr>
<tr>
<td>14</td>
<td>L12</td>
<td>Read data</td>
</tr>
<tr>
<td>15</td>
<td>L13</td>
<td>Change disk</td>
</tr>
</tbody>
</table>

**RS232 interface: XS5**

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-DCD</td>
<td>Carrier detect</td>
</tr>
<tr>
<td>2</td>
<td>RXD</td>
<td>Receive data</td>
</tr>
<tr>
<td>3</td>
<td>TXD</td>
<td>Send data</td>
</tr>
<tr>
<td>4</td>
<td>-DTR</td>
<td>DTR</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Signal GND</td>
</tr>
<tr>
<td>6</td>
<td>-DSR</td>
<td>DSR</td>
</tr>
<tr>
<td>7</td>
<td>-RTS</td>
<td>Require to send</td>
</tr>
<tr>
<td>8</td>
<td>-CTS</td>
<td>Permission to send</td>
</tr>
<tr>
<td>9</td>
<td>-RI</td>
<td>Vibration</td>
</tr>
</tbody>
</table>

**Handheld unit interface: XS8**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>24V, 24VG</td>
<td>DC24V power output</td>
</tr>
<tr>
<td>ESTOP2, ESTOP3</td>
<td>Handheld unit E-stop button</td>
</tr>
<tr>
<td>132-139</td>
<td>Switch I/P for handheld unit</td>
</tr>
<tr>
<td>028-031</td>
<td>Switch O/P for handheld unit</td>
</tr>
<tr>
<td>HA</td>
<td>Handheld A phase</td>
</tr>
<tr>
<td>HB</td>
<td>Handheld B phase</td>
</tr>
<tr>
<td>+5V, 5VG</td>
<td>Handheld DC5V power</td>
</tr>
</tbody>
</table>

**Spindle control interface: XS9**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>SA+, SA-</td>
<td>SPD coded disk A phase feedback signal</td>
</tr>
<tr>
<td>SB+, SB-</td>
<td>SPD coded disk B phase feedback signal</td>
</tr>
<tr>
<td>SZ+, SZ-</td>
<td>SPD coded disk Z pulse feedback</td>
</tr>
<tr>
<td>+5V, GND</td>
<td>DC5V power</td>
</tr>
<tr>
<td>AOUT1, AOUT2</td>
<td>SPD analog instruction O/P</td>
</tr>
<tr>
<td>GND</td>
<td>Analog O/P GND</td>
</tr>
</tbody>
</table>

**Switch Value I/O interfaces**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>24V, 24VG</td>
<td>DC24V power O/P</td>
</tr>
<tr>
<td>ESTIPI, ESTOP3</td>
<td>Handheld unit E-stop button</td>
</tr>
<tr>
<td>132-139</td>
<td>Switch I/P for handheld unit</td>
</tr>
<tr>
<td>028-031</td>
<td>Switch O/P for handheld unit</td>
</tr>
</tbody>
</table>
Feed Axes control interfaces

- Analog, pulse servo (model 16 servo unit) & step motor drive unit control interfaces
Notes: ( ) is the dimension for HNC-22

HNC-21/22 order information

Discription:
HNC - 21 M D - 32 - F 32

HNC-21: Universal system
HNC-22: Function system

Types
M: Milling
T: Turning

Memory capacity
Unit: MB

Storage capacity
Unit:
Low capacity - MB
Low capacity - GB

Types of feed axes interfaces
D: pulse, for pulse or step drive

Storage types
F: small capacity CF card
H: High capacity CF card