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Collecting Data on the Factory Floor with a DNC System

Machine Status Data

Manufacturers want to collect machine data for many reasons. Here are some:

- Remotely view current shop status
 - Machine: Idle, Running, On Hold, Setting up, Breaking down . . .
 - What job/part program is running and how much is completed.
 - Is the program running using the programmed feeds and spindle speeds or has the operator overridden them.
 - Who is running the machine.
- Keep parts count and time to make and amount of scrap.
- Historical Utilization data for productivity and maintenance purposes.
 - Efficiency information such as how much time the machine is actually producing part vs. idle time and why.

Methods for collecting machine data

Data can be collected manually, automatically and somewhere in between. This can be via manual data entry on a computer screen, terminal or barcode reader at the machine; it can be via Remote Request data entered manually using the CNC's editor and sent by the operator via the RS-232 port; it can be by sensing and interpreting hardware I/O lines; it can be by getting status information via the RS-232 port or Ethernet using a CNC's special protocol, or getting status information via the RS-232 port using programmed "Macro B" or similar feature of the CNC in question.

There is no one size fits all solution to machine data collection. Each machine is different. Each N/C or CNC is different. Each shop's requirements are different.

The following chart shows pros and cons of the various methods

Method	Pro's	Con's
Manual Data Entry via computer keyboard, terminal or barcode reader	<ul style="list-style-type: none"> • Requires no wiring or connections at the machine. • Requires no special options on the CNC. • Requires no changes to part programs. • Can collect any information required. 	<ul style="list-style-type: none"> • Depends upon the operator entering correct data • Requires computers, terminals, arcode readers at or near each machine.
Manual Data sent via Remote Command files using the CNC's editor and sent to the DNC system via the RS-232 port	<ul style="list-style-type: none"> • Requires no wiring or connections at the machine. • Requires no special options on the CNC. • Requires no changes to part programs. • Does not require computers, terminals or barcode readers at or near each machine 	<ul style="list-style-type: none"> • Depends upon the operator entering correct data • Requires training the operator • Is not in real time and cannot give detailed machine or program status during the running of a part program
Sensing and Interpreting hardware I/O lines from the CNC o Fully automatic requiring no operator training or intervention.	<ul style="list-style-type: none"> • Can supply almost everything about the machine's status and outputs the data in real time as events occur. Does not have to be queried. • Does not require computers, terminals or barcode readers at or near each machine. • Requires I/O signals being available – these signals can be "mined" by an engineer using the machine builders wiring diagrams and/or finding them empirically at the machine or specifying the requirements on a new machine or having them added by the machine tool builder. In either case there is the expense of finding the signals or paying the machine tool builder to add them. 	<ul style="list-style-type: none"> • Requires interface hardware to sense these signals and transform them it a format that the data collection software can use. • Requires interpretation of these signals. For example, on one CNC being 'In Cycle' turns an I/O line to 5 volts. On another CNC the signal might go to 24 volts or 0 volts. On one CNC the mode might be determined by a single signal for each mode. On another CNC the mode might be encoded into 3 lines. • Need to use some manual data input method or software RS-232 or Ethernet method to get data as to what program is running and who is running it for what job as well as information such as Machine

		Setup, Breakdown, Idle, Waiting for Material, Under Maintenance etc.
Software method using a CNC's special protocol	<ul style="list-style-type: none"> • Fully automatic requiring no operator intervention • Might Collect data in real time • Requires no wiring or connections at the machine • Requires no changes to part programs • Does not require computers, terminals or barcode readers at or near each machine 	<ul style="list-style-type: none"> • Special protocols are usually options that have to be purchased • These special protocols are different for each CNC hence require the DNC software to support all these different unlike protocol increasing the costs of the software • The special protocols might not provide all the data required such as job numbers and operator. • The special protocols do not usually output data as the events happen but have to be queried by the DNC software
Software method using "Macro B"	<ul style="list-style-type: none"> • Fully automatic requiring no operator training or intervention • Requires no wiring or connections at the machine • Data is output automatically – does not require any query. • Does not require computers, terminals or barcode readers at or near each machine • Macro B is usually an option that has to be purchased 	<ul style="list-style-type: none"> • Requires changes to part programs to output the data. • What can be collected is limited to parts count and time and program status. Does not provide all the data often required such as times when the machine is in Hold or Single Block Mode. • Not real time – data is output as the part program is executed. If the program stops or there is a machine alarm no more data is sent.

Summary

DNC software shop floor data collection features can range from having fixed manual data input forms; fixed remote command data output methods; fixed requirements for getting data via RS-232 ports or Ethernet communication; and/or fixed numbers of I/O lines interpreted in a fixed way; or provide a full blown customizable system where the end user can specify or and configure the I/O and reports to the specific needs of the organization. All these methods or combinations of them are possible. It's a matter of cost effectiveness as to which method, if any, a customer determines has the best ROI.