PLC Type Traceability Considerations Guideline

SD-1035

ISSUED December 7, 2011
REVISED August 21, 2012

© 2011 Nexteer Automotive Corporation

All rights reserved

	21AU12
Larry Morel Sr. Staff Controls Engineer	Date

Nexteer Automotive uses Rockwell MicroLogix and CompactLogix PLCs. The intent of this document is to assist Controls Engineers, Manufacturing Engineers and equipment suppliers to select the appropriate PLC for equipment with traceability requirements. A Micrologix controller cannot be used for all traceability applications. Although a MicroLogix may be capable of controlling the basic machine motions and functions, the Traceability limitations below shall be reviewed to determine when a CompactLogix is required.

Micrologix traceability limitations:

To send more than 20 pieces of part process data
requires the use of a CompactLogix

To look up more than "basic" information (basic information being previous Station ID or OP number, part status, model, and elapsed time since previous OP)
requires the use of a CompactLogix

To look up information from any station other than the previous Station
requires the use of a CompactLogix

To look up information for more than two (2) incoming components
requires the use of a CompactLogix

For machine logic greater than 10Kbytes
requires the use of a CompactLogix

For applications with more than one fixture, tooling, or station per PLC
requires the use of a CompactLogix

To send process data for more than one part at a single station
requires the use of a CompactLogix

For data required to be in floating point within the PLC.
requires the use of a CompactLogix

For auxiliary devices that communicate data to the PLC in a string of more than 80 characters
requires the use of a CompactLogix

Explanation:
The following information further explains the considerations for the above requirements:

1. **Amount of data / type of data**
   a. All traceability data (either numeric or ASCII) must be converted to, and communicated in, a string format, and the MicroLogix string length is limited to 80 characters (Note: The CompactLogix defaults to 82 characters and in Nexteer traceability applications is typically customized to greater lengths).
   b. Therefore, **any data whether in the PLC or communicated from auxiliary devices through the PLC, must be ≤ 80 characters** to use a MicroLogix controller.
   c. For reference: Current data such as REPS serial numbers are typically 12 to 20 characters in length.
   d. Because the MicroLogix can only convert integer data (16 bit, ±32,767) to this string format (logic conversion is not practical for floating point values), applications with **PLC data required in floating point need to be done in a CompactLogix**.

2. **Auxiliary devices (communications / data)**
   a. If the communications methods from auxiliary devices to the PLC are outside of the communication capabilities of the MicroLogix, or if the amount of data from the auxiliary device is greater than 80 characters based on 1.b. above, then a **CompactLogix would be required**.
   b. Example: An axis-control device that communicates four 5-digit values such as insertion force, depth, maximum running load, and minimum running load to a PLC address can do that with as few as 20 characters and therefore can communicate to a MicroLogix.

3. **Traceability communication functions (from PLC)**
   a. Within the constraints of the current traceability application software (PC software) there are a number of communication functions (communication is always initiated by the PLC).
   b. Two of the most frequently used functions have been considered:
      i. simple communication of process data **from** the PLC to traceability, and
      ii. a request of data **from** the traceability for permission-to-run.
   c. The MicroLogix traceability application (PC software) cannot return data that was generated by any operation other than the **last** station the part was processed at. (See Permission-to-run section below).

4. **Communication of process data**
   Communication of process data from the PLC to traceability typically places no restrictions on the PLC (or, restrictions are defined in all other sections of this document).
   a. With every traceability record there is a small amount of header data being communicated, including part status, model, (station or OP number is part of the set-up of PC and communications). This communication header data is not part of the data limitations listed in item 7.a. below.
   b. Communication bits such as *DataReady* are not part of the header, and are not part of the data limitation listed in item 7.a. below.
   c. **Communications of process data for more than one part at a single station requires a CompactLogix**. Example: Consider a station that assembles a pinion assembly to a pinion housing where both the pinion and the housing each have their own traceability records to this point. Typically this station's process data would **only** be associated with the pinion housing serial number once assembled, in which case a MicroLogix could be used. However, communication of process data for **both** the pinion assembly and the pinion housing would **require the CompactLogix** traceability routines.

5. **Tooling / # of stations**
   a. Based on all the constraints of items above, and PLC Memory discussions below, the **MicroLogix shall only be used for applications that include one PLC per station**.
   b. This also requires one PLC per fixture, that is to say if a single SD# has two separate processing fixtures (no matter how simple) and there is any traceability requirements at each fixture, then each fixture shall have its own MicroLogix, or the entire SD# **shall be controlled by a single CompactLogix** PLC.

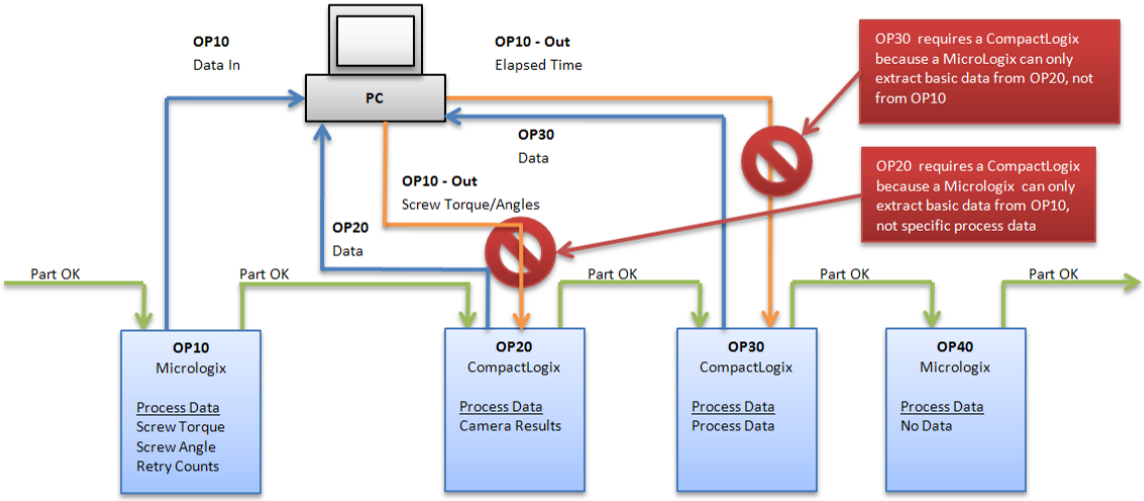
6. **Permission-to-run**

   Communication for permission-to-run is a request by the PLC for data **from** the traceability PC concerning the part(s) being processed at a station.

   a. Basic "permission-to-run" is a request for header data, that being: previous Station ID (or OP type?), Part Status, Model, and elapsed time (from previous operation). This information is standard from the **common traceability application and a MicroLogix** can be used.

   b. There are several variants to this basic request that are often requested, are not practical for the MicroLogix template, and therefore **require the CompactLogix** traceability application logic.

      i. Variant 1: Additional data **from** a previous operation such as the previous operation model or previous operation process specific data such as screw torques and angles (see OP20 below). For this variant **a CompactLogix is required**.



      ii. Variant 2: Requesting data or permission from an operation other than the previous operation. The data requirements and request for such an application can be very unique such as requesting elapsed time since two stations prior (see OP30 above). For this variant **a CompactLogix is required**.

      iii. Variant 3: Requests for information on more than two incoming parts **requires a CompactLogix**.

7. **PLC memory**

   a. Understanding from past processes and experience with traceability applications, and a practical look at the memory size of the MicroLogix controller, stations that have **more than 20 points of process data require a CompactLogix.** This process data is in addition to the header data detailed in 4.a. above.

   b. Considering all of the constraints detailed within this document a MicroLogix design sample was created. This example used 3Kbyte of the 15Kbyte existing memory (20% of the memory of the largest MicroLogix 1400).

      i. The Nexteer Logic500 Template 23JA12.RSS (or later revisions) include traceability routines.

   c. Therefore, **machine logic requiring more than 10 Kbyte must use a CompactLogix**.

      i. This is 10Kbyte of just machine logic.

      ii. This leaves only 2Kbytes (20%) for plant modifications

RECORD OF REVISIONS

Revision #	Date	Section	Description
001	O7DE2011	All	Initial Release
002	21AU2012	All	Clarification and detail
003			
004			
005			
006			
007			
008			
009			
010			
011			
012			
013			
014			
015			
016			
017			
018			
019			
020			