Absolutely! The **GPO (Get Processing Options)** command is one of the **core steps in the EMV transaction flow**. It's where the terminal and card finalize how the transaction should proceed (offline, online, CVM methods, risk management, etc.).

Let's go **in-depth into everything about the GPO command**, including:

✅ Contents:

◆ 1. What is the GPO Command?

GPO = Get Processing Options

It's an **APDU command** sent by the terminal to the card **after reading the application data** (AID, AIP, etc.).

🧠 Purpose: To tell the card "Here's what I support" and to receive back instructions on **how to proceed with processing.**

It returns key data like:

- AIP (Application Interchange Profile)

- AFL (Application File Locator)

- CTQ (Card Transaction Qualifiers) for contactless

- Possibly more (scheme-dependent)

◆ 2. When is GPO Used?

In the **EMV transaction sequence**, it comes right after:

- **SELECT AID**

- **READ RECORDS (if needed)**

- Then: **GPO**

It's part of the **Initiate Application Processing** step.

◆ 3. GPO Command Format (APDU)

🔧 Standard APDU Format:

less

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CLA | INS | P1 | P2 | Lc | Data | Le

◆ For GPO:

Field Value

CLA 80

INS A8

P1   00

P2   00

Lc   Length of Data

Data Encoded PDOL values

Le   00 (expected length of response)

◆ 4. PDOL – Processing Data Object List

PDOL = **A list of tags** the card expects from the terminal in the GPO command.

The card gives PDOL in the FCI Template (response to SELECT AID):

javascript

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Tag 9F38: Processing Data Object List

This list defines what the terminal must send — commonly includes:

- 9F66 – Terminal Transaction Qualifiers (TTQ)

- 9F02 – Amount, Authorised

- 9F37 – Unpredictable number

- 9F1A – Terminal country code

- 95 – TVR (initial)

- 5F2A – Transaction currency code

- 9A – Transaction date

- 9C – Transaction type

- 9F21 – Time

- …

The terminal parses PDOL and then builds the **Data field** for GPO using matching TLVs or just the raw values in a **BER-TLV constructed format**.

- ◆ **Example PDOL:**

plaintext

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9F38 0F

 9F66 04 (TTQ)

 9F02 06 (Amount)

 9F37 04 (Unpredictable number)

 9F1A 02 (Country Code)

 95   05 (TVR)

 5F2A 02 (Currency Code)

 9A   03 (Date)

 9C   01 (Txn Type)

◆ **Example Data (raw value to send to card):**

If TTQ = E00000, Amount = 000000010000, etc., then final encoded value might look like:

css

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83 20 [actual value bytes]

Where:

- 83 is the tag (for data field structure in GPO)

- 20 is the length of data

- Followed by concatenated values (in order of PDOL)

◆ **5. GPO Response – Format 1 vs Format 2**

There are **two response formats** defined in EMV Book 3:

◆ **Format 1 (Common in Contactless):**

Simple response:

scss

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77 len

 82 XX XX → AIP

 94 …   → AFL

 9F6C … → CTQ (contactless cards only)

 [other tags like 9F10, 9F36, 9F27…]

◆ **Format 2 (Simpler/legacy format):**

python

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80 len

Response Template Format 2

First 2 bytes = AIP

Remaining = AFL

Example:

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80 0A

 12 34 → AIP

 08 01 01 00 10 02 02 00 → AFL

Note: Format 2 omits tag identifiers (82, 94), just raw values.

◆ **6. Tags Returned in GPO Response**

Tag	Meaning	Description
82	AIP	Application Interchange Profile (card capabilities)
94	AFL	Application File Locator (what records to read next)
9F6C	CTQ	Card Transaction Qualifiers (used in contactless)
9F10	Issuer Application Data (IAD)	Returned later, but sometimes included
9F36	ATC (App Transaction Counter)	Present in some cases
9F27	Cryptogram Information Data	For CDA
9F4B	Signed Dynamic App Data (for DDA)	

◆ **7. Real GPO Example**

GPO Request APDU:

csharp

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80 A8 00 00 23

83 21

  [Concatenated PDOL values for TTQ, Amount, TVR, etc.]

00

GPO Response:

objectivec

CopyEdit

77 0F

 82 38 00 → AIP

 94 08 01 01 00 10 02 02 00 → AFL

 9F6C 02 E0 90 → CTQ (for contactless)

Breakdown:

- AIP = 38 00 → card supports SDA, DDA, terminal risk management

- AFL → tells terminal what records to read next

- CTQ → tells terminal how card wants to proceed with contactless

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◆ **8. What Happens If GPO Fails?**

Possible issues:

- PDOL not fulfilled → card may reject GPO

- Wrong data lengths → card returns SW1/SW2 like 6A80 (incorrect data)

- Card returns 6985 → conditions not satisfied

- Terminal does not follow order of PDOL → failure

In such cases, the terminal **may fallback** to magstripe or **decline** transaction.

◆ **9. Summary**

Item	Description
Command	GPO (Get Processing Options)

Item	Description
APDU	80 A8 00 00 Lc [PDOL data] 00
Purpose	Tell card what terminal supports (via TTQ and others)
Card Responds	AIP (capabilities), AFL (records), CTQ (contactless)
Used in	EMV and Contactless (PayWave, PayPass, etc.)
Failure	Stops transaction or forces fallback
Critical	Sets foundation for CVM, ODA, terminal risk, GAC input